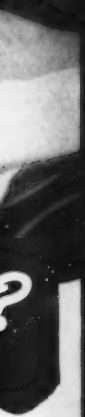
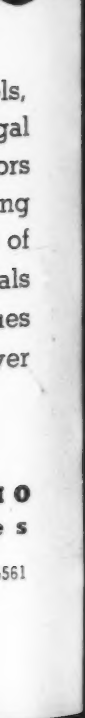
Industrial Arts and VOCATIONAL EDUCATION





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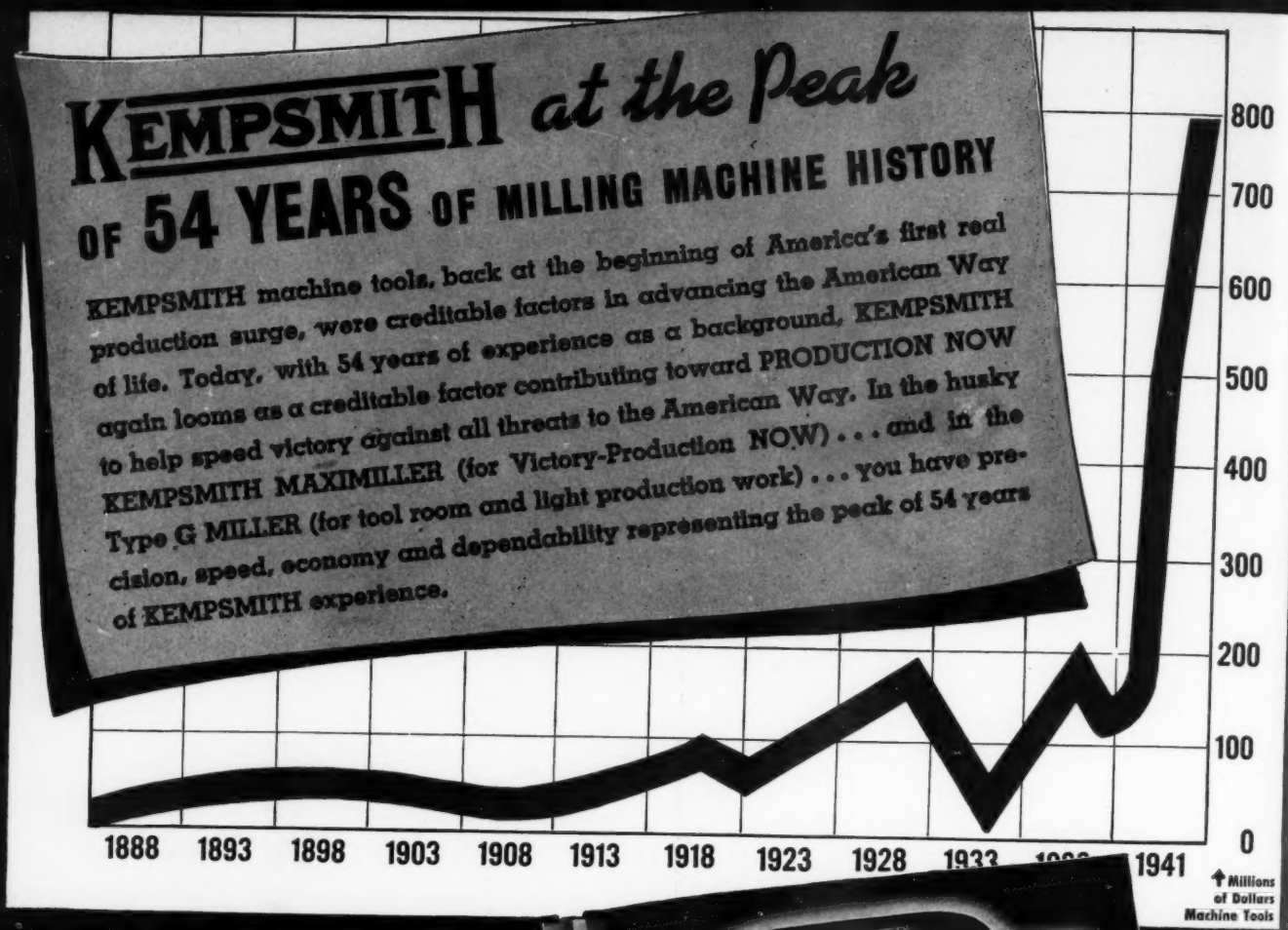
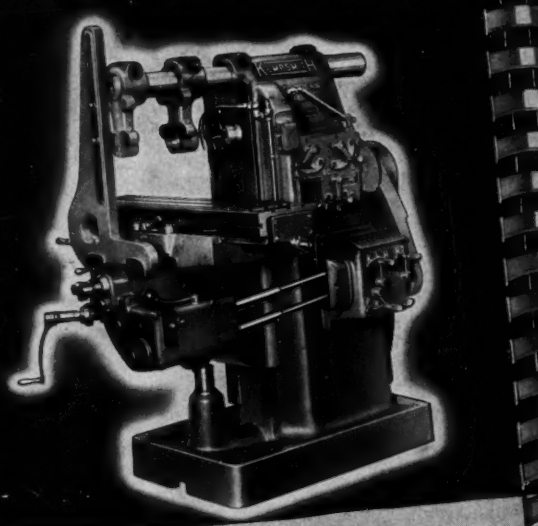
OF 54 YEARS OF MILLING MACHINE HISTORY

KEMPSMITH machine tools, back at the beginning of America's first real production surge, were creditable factors in advancing the American Way of life. Today, with 54 years of experience as a background, KEMPSMITH again looms as a creditable factor contributing toward PRODUCTION NOW to help speed victory against all threats to the American Way. In the husky KEMPSMITH MAXIMILLER (for Victory-Production NOW) . . . and in the Type G MILLER (for tool room and light production work) . . . you have precision, speed, economy and dependability representing the peak of 54 years of KEMPSMITH experience.





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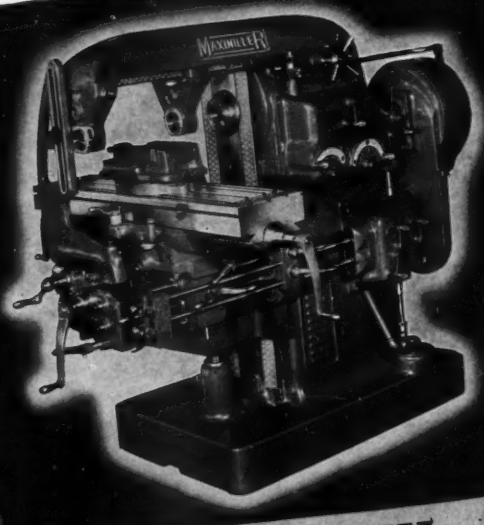

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PRECISION

MILLING MACHINERY

Experience SINCE 1888

KEMPSMITH MACHINE CO.

MILWAUKEE • WISCONSIN

INDUSTRIAL ARTS *and* VOCATIONAL EDUCATION

VOL. 31 NOVEMBER, 1942 Number 9

TOLEDO—THE A.V.A. CONVENTION CITY

The members of the American Vocational Association will meet December 2 to 5 at Toledo, Ohio, to discuss the question of "How vocational education can improve and speed the training of workers and students for the war effort."

Toledo, with its factories busy on war-production work, and its well-developed courses of industrial arts in 34 elementary schools, three junior high schools, and five senior high schools and the excellent vocational courses offered in its vocational high schools, presents an ideal city for a convention of the type planned by the officers of the A.V.A.

THIS MONTH'S COVER

The cover illustration for this month shows a strikingly patriotic display which has been placed in the Union Depot at Chicago.

The 4500 model airplanes suspended from the ceiling are shown flying east from the mural "For Us Bonds" on the left, toward the mural "For Them Bombs," shown on the right.

Photograph courtesy of the Chicago and Cook County Building and Construction Trades Council.

STATE CONVENTIONS

November will witness the assembly of many teachers in their state association conventions. In many cases the industrial-arts teachers will have their own sectional meetings.

Much good is accomplished in these conferences, and especially in times like these, the pooling of ideas on how pressing problems may be solved, is very necessary.

The Wisconsin Industrial Arts Association, for instance, will have the "Responsibility of Industrial Arts in the Present Crisis" discussed from industry's viewpoint by Dr. Stewart Scrimshaw, and from the school administrator's viewpoint by W. C. Giese, superintendent of schools, Racine, Wis.

The addresses just mentioned have been scheduled for November 5. Sectional meetings will be held by the group on November 6.

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SAFE • HEAVY • STRONG

J-45 SANDER

VAST military operations must be backed up with industrial activity equally as great in scope. Such activity necessarily includes a large percentage of production in wood. To meet the demand for new workers in this field, vocational schools everywhere are training thousands of students in these needed skills — on Yates-American machines in the majority of cases.

This is to be expected, for as the world's largest manufacturer of woodworking machines it is but natural that this company's school machines should be accepted with the same readiness as are its heavy, industrial, production-type machines.

The J-45 Spindle Sander, illustrated, is a member of Yates-American's "J" Line, a correlated group of medium capacity machines especially designed to meet the requirements of the school field.

It is ruggedly built for continuous service. The base is a heavy one-piece casting which not only provides a strong foundation but also serves to enclose the drive motor and the entire oscillating mechanism. The table tilts 45° to the left and 15° to the right. In cabinet work and pattern making this sander saves hours of tedious hand labor on internal and irregular surfaces.

YATES-AMERICAN MACHINE COMPANY • BELOIT, WISCONSIN

Short Talks on Wood

TAMARACK (*Larix laricina*)

The only cone bearing tree in this country which sheds its needles in autumn. Also known as Eastern Larch. Distinctly a northern tree. The wood is heavy, hard, strong and durable in contact with soil. Close-grained, resinous, seasons well, is somewhat difficult to work. Takes a good finish. Light brown in color.

Employed in the production of ships, canoes, railroad ties, telephone poles and fence posts. Also used for interior finish, tanks, pails, boxes, crates and excelsior.

Range extends from Maine westward to Minnesota and southward to Pennsylvania and Illinois. Grows in greatest abundance in southern Canada. Found mostly in cool swampy locations although it will grow in well-drained soil. Intolerant of shade. Fairly rapid in growth.

A medium-sized tree, usually about 50 to 60 feet in height and 1 to 2 feet in diameter. The trunk is continuous and tapers rapidly. Head is regular, narrow and pyramidal in the forest, but broad, open and flat when growing alone. Has a shallow root system. A handsome tree when in foliage.

The bark is smooth and separates into thin reddish-brown scales. The needles are from ¾" to 1" long, triangular in section, soft and are borne in clusters of 10 or more. They are bright green in summer and dull yellow in autumn before they fall. The cones are small, not over ¾" long, and have about 20 thin, leathery, light-brown scales. They remain on the tree over winter.

To date, thirty-nine brief articles similar to the one above and dealing with the more commonly used woods have appeared in these ads. As in the past, we continue to invite your suggestions as to the species of wood you would like featured in this series.

YATES-AMERICAN

INDUSTRIAL ARTS *and* VOCATIONAL EDUCATION

A Program for Conserving Shop Tools and Equipment

PHILIP L. McNAMEE*

Programs for the conserving of hand tools and shop equipment are not new. They have been confronting school boards for years, and have formed the basis of many hours of shop discussion at school supervisors' meetings. Likewise, the problems that are involved in a program of this type are well known to schoolmen, and have been given considerable attention, resulting in numerous suggestions and a variety of methods of solution.

There is no denying that the methods that originated from these meetings have been quite helpful, and that they produced good results when followed in an orthodox fashion. Neither is there any denial of the fact that modern business methods, instituted some eight or nine years ago, produced conservation systems that worked out exceedingly well. Foresighted school boards installed bureaus of conservation, such as the bureau of property control, the bureau of educational expenditures, and the bureau of purchases. School superintendents had developed ideas with respect to school items that resulted in inventory systems, and shop supervisors, either by bulletin or by personal call, acquainted the shop teachers with what was expected of them.

In spite of all these movements, however, many school boards are today experiencing a problem that has arisen in the past two years, and not having been forewarned, were certainly not forearmed. No handwriting appeared on the shop walls to acquaint them with the fact that emergency measures might have to be resorted to, if the shops were to continue to function to their highest efficiency. The standard conservation programs in vogue at the time, are no longer able to provide for this emergency, because of the rigidity that confines their usefulness to normal operating conditions.

*Assistant Superintendent of Schools and Director, National Defense Training Program, Chicago Public Schools, Chicago, Ill.

Vocational schools and technical schools today are far from normal. Extended daily programs are now the rule throughout the nation. In some cities, schools operate on a 24-hour day, with as many as four instructors conducting classes throughout the day. Academic rooms undergo a change at the end of the regular school day, accommodating classes in precision inspection work, bench assembly work, and other types of training for workers for the war-production program. Even the rugged individuality of gymnasiums disappears around three o'clock in the afternoon, when a class in shiplofting utilizes the floor for their layout work.

The problem with respect to the physical transformation is not so important at present, however, as that which concerns the equipment. Changes in shops, rooms, or other parts of the building have been worked out, thanks to the cooperative assistance of the men in charge of these departments, and in our city, classes have been held on the date assigned regardless of the magnitude of the transformation.

In the equipment field, the machine shops were the first to be considered in the conservation program. They have always carried heavy enrollments, and the problem of operating the machines for 140 hours per week, 52 weeks of the year, appeared to be the major item of consideration. Furthermore, it was felt that if a program could be evolved, which would not sacrifice the regular day school program, nor curtail the evening and war-production training programs, a real starting point would have been made.

In Chicago, we were fortunate in having had a committee functioning on all machinery purchased. Board members, labor representatives, shop supervisors, and machinery men composed this committee. The result was that our machines were purchased with the thought in mind of the usage to which they would be subjected. Heavy, rugged machinery was, therefore, chosen, and the wisdom of the selections was reflected in a survey conducted by the machine-shop teachers in the trade and vocational schools. This study disclosed the fact that the few breakdowns were minor in character, and that little time was used to replace the damaged part.

Another strong factor was the maintenance programs that had been instituted by the bureaus of repairs. Frequent examination had been customary in each shop, and the maintenance men in the schools had taken over the weekly lubrication and minor inspectional duties. These men answered to their own departmental chief, and the entire responsibility for these duties was vested with them.

It, therefore, appeared as if an extension of the duties and more frequent periods of inspection would serve to safeguard these machines that would be working for the lengthened day. However, it was felt that in our own situation, we should have some data to work out the frequency of the inspection periods, as well as to determine the mortality rates of the parts that were being damaged, so that if replacement parts would be necessary, no time would elapse between the shutdown and the replacement.

With this idea in mind, a committee chosen from the shop teachers in the trade and vocational schools was found. An office supervisor was assigned to conduct the committee meetings, and to record progress made at each session. This move proved to be excellent, as it provided a liaison officer between the committee and the many bureaus housed in the central office. It also acted as a buffer between the busy executives and the individual shop teachers.

The first meeting resulted in the adoption of forms to be used in making a survey. Spaces were allotted for reporting the nature of machine breakdowns, the parts necessary, the time for making repairs, etc. As already mentioned, however, the efficient methods pursued by the board ma-

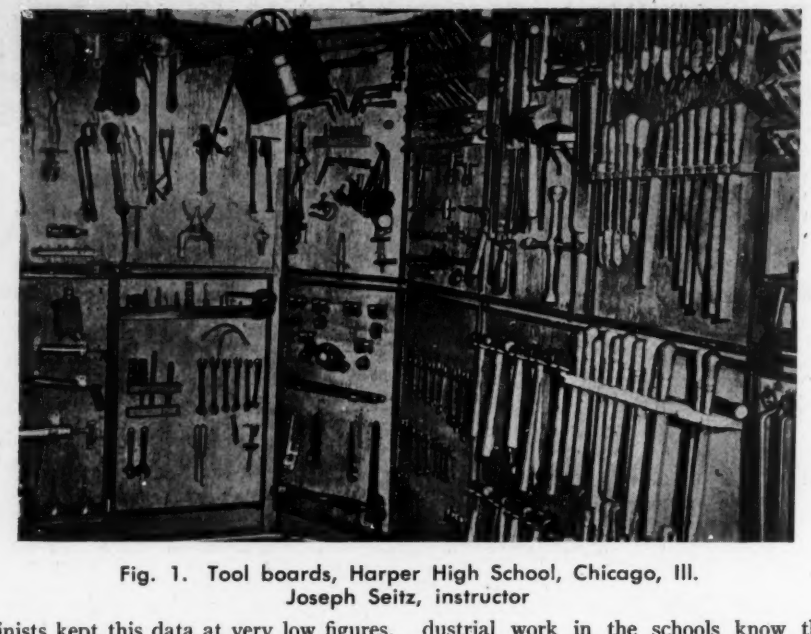

Fig. 1. Tool boards, Harper High School, Chicago, Ill.
Joseph Seitz, instructor

chinists kept this data at very low figures, so that the original reports could not provide us with the information we had to have. It was then decided to select certain industrial plants and to draw up tentative mortality rates. Armed with these sets of figures, the committee began to lay out definite procedures which would be of value in this program.

The result of this was a more frequent period of inspection, and the changing over of certain exercises that heretofore had been inserted in the courses of study. Newer projects were based on parts that might be hard to obtain, or parts that had a higher mortality rate than the others. Drawings for gears, tool-post holders, centers, etc., were made so that these articles could be made as regular jobs by the students. The finished articles were made to pass the regular inspection department, after which they were prorated to the different schools and held in reserve.

Maintenance schedules were also revised, and the instructor on duty made a final inspection before turning the room over to his successor. Additional instructors were selected from maintenance fields and given short courses with our regular instructors, so that they would have the school approach to the problem, plus the maintenance experience, in order to make sure that inspections were complete and that full reports would be made to the proper bureaus.

As far as the results from this program are concerned, we have only the operating figures to go on, but even at this date we are fortunate in not having had a major shutdown. Just what our situation will be next year is problematical, but we feel that the consciousness that now permeates the shops, and has since the inauguration of the program, may be a harbinger of another successful period.

Hand tools provided another type of problem. All persons connected with industrial work in the schools know that tools may be lost, stolen, or destroyed. There is very little difference in the final result under which of these classifications the missing tool falls. However, property bureaus and inventory systems placed the responsibility for losses under the first two headings, directly on the teacher, who had to render an accurate account of what had been charged to him. Then, too, purchasing bureaus had insisted upon guaranteed tools, so that accidental breakage or defective merchandise was replaceable. This is mentioned in order to show that this problem had already received considerable attention.

These precautionary measures had been of considerable assistance through the years, and had held our tool supply curve to a standard pattern, but in the light of the extra usage to which tools would be put on the extended program, we required approximate life, methods of replacement, and methods of quick and accurate distribution. The committee reported that investigations in various schools disclosed an average amount of tools in one shop, and a partial absence in some other shops.

The first problem to be undertaken was that of distribution. Various factors entered into the solution of this distribution problem. Cases where one instructor would use all of his appropriation for hand tools, and then borrow supplies for projects from his associates came up for consideration. So, too, did the problem of the perennial budget exceeder, and many others of a kindred nature. Inasmuch as these seemed to be local school problems, the topic of organization entered into the discussion.

Normally, shop control would be under the supervisor's jurisdiction, and the usual method would be for the shop instructor to make out his order, have it approved by the supervisor, have it signed by the principal, and then forwarded to the supply offices. It was felt that this method under the stricter conditions would be ineffective, inasmuch as it could not control the evils of the distributive system then in effect. To offset this condition, a local committee was formed in each vocational school and war-production training program. The duties of this committee were to collect all orders, arrange the items into groups for lump purchasing, arrange a proper method of distribution, provide a record system of hours of use for each of the more frequently ordered hand tools, and to assist in other directions for the general improvement of the entire program.

This equitable distribution was arranged on the number of stations, rather than on

Fig. 2. Tool-board arrangement

the number of pupils. Stations were considered for the number of scholastic and training operations that could be performed, and from these operations a list of the tools that would be required was obtained. The next step, therefore, was to decide upon some method of arranging these tools so that they would be pertinent to the training to be given at that station.

The long-abused tool board was resurrected for this purpose and was found to be so effective that it now appears as if all the organization problems might be answered through a general adoption of this method of taking care of tool storage. The first tool boards constructed were merely for carrying tools, although one or two appeared wherein an elementary attempt was made to keep up an appearance, but it remained for Joseph Seitz, instructor at the Chicago Vocational School, to extract the largest utility range for shops from this unit.

Figure 1 shows the toolroom at the Harper High School, arranged by Mr. Seitz. The tool boards here are of standard pattern and size. They may be removed at the beginning of a class and carried to a station or stations, for a study of the illustration shows that one board may accommodate as high as six training stations. Here again was the answer for the provision of tools for academic rooms that could be quickly converted into shops for additional training programs. Here also was the answer of how to expedite the checking of the tool situation by the instructor going off duty and the instructor coming on duty, so as to fix the responsibility for the condition of the tools, and whether any were missing.

Figures 2 and 3 show two views of the arrangement worked out by Drew Wilson, of the Washburne Trade School. This grouping was decided upon to accommodate a shop that had a regular trade day school, an apprentice training program, war-production trainees, and a standard evening school group. Instead of using tool checks when issuing tools, Mr. Wilson kept a record system, finding it avoided the customary crowding around in waiting for checks to be returned. At the close of the period, tools would be taken from the large container and hung in their respective places. A glance over the boards told the toolman if any were missing, when a check with the record would fix the responsibility. This system released tools from the individual benches, and allowed fewer tools to take care of the requirements for all classes.

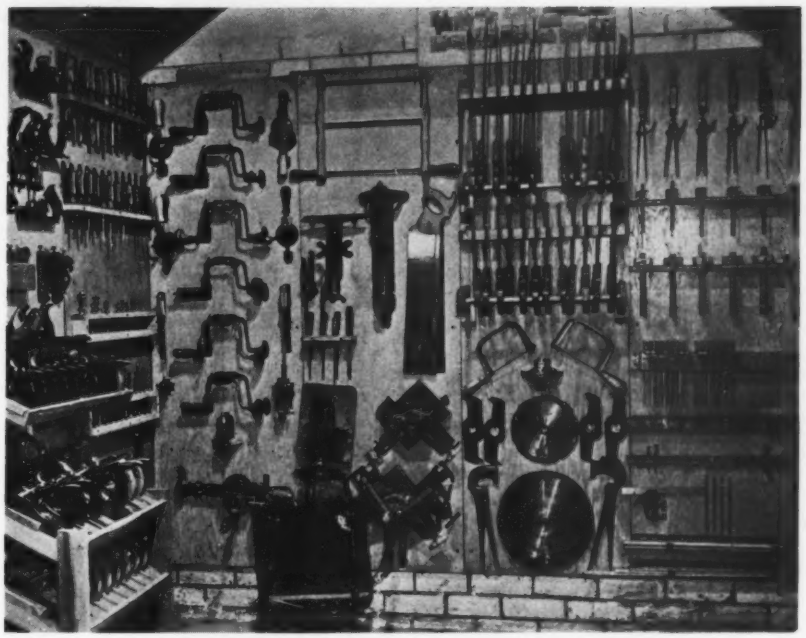

Fig. 3. Tool-board arrangement

Defective tools were held to a minimum with a system worked out by Mr. Seitz for the Chicago Vocational School. Imbued with an enthusiastic approach obtained from Webster's definition of the term *conserve*, i.e., "Conserve — to keep from loss; to keep from injury; to supervise and protect," Mr. Seitz designed these panels so as to expedite supervision and assure the protection needed in a good conservation program.

The protection feature is twofold; first, by using this type of board and adding a daily inspection to the program, no loose hammer handles, chipped sockets, worn wrenches, or dull chisels can be put again into service without reconditioning them. This affords first aid for the tool. The second protective feature is that coming under the heading of *Shop Safety*, for the dangers prevalent with using defective tools have now been removed. Some instructors have found the daily inspection to actually take only one fourth the time that formerly was spent in discussing safety and defective tools. There is no need, of course, to mention the loss or theft possibility. In this particular shop there has been no loss for an entire year. See Figure 4.

Notice that only one tool of each size is hung upon these boards. This does away with the student argumenting about who is to use the *new* tool. It has been our experience that if several tools of each size are available, an issued article is frequently refused, on the grounds that a better tool was still on the tool board.

To further the conservation program, entire toolrooms were rebuilt in order to conform to the new system.

Fig. 4. A well arranged tool board

Figure 5 shows an arrangement laid out and reproduced in the Washburne Trade School. Formerly, three separate toolrooms were necessary, while even the skeletonized equipment for each room required an overlapping which might have been done away with. Three individual toolmen were required under the old setup; today, due to the forethought in designing a master toolroom, only one man is necessary. Shop accessories have been materially reduced, while from the inspection angle, all units are easily accessible.

This work was done by the framing, lathing, plastering, lighting, and painting apprentices who worked this out as a regular project, while the supervisor acted as supervision architect. Receiving bins were built beneath the counters, and tools were replaced in the racks after the class had left. The check exchange system was used in this toolroom with excellent results.

A great many of our shops are also busily engaged in making hand tools, but where before the finished article was taken by the person making the tool, paying only a small price for the material into the school fund, the article now reverts back to the school for later distribution. The committee culled the fields for possibilities of adding to the stock; body and fender tools were cast in the school foundries; wrenches, calipers, and many other tools made in the machine shops; and other articles inserted in the training courses.

Figure 6 shows a board involving a project display plus an assortment of hand tools used for checking the projects for accuracy. This board was designed by Mr. Andrew Scholar, instructor on the Navy Teacher Training Program at the Chicago Vocational School. A great many of these boards have been built and are used in the hand-tool classes at this building.

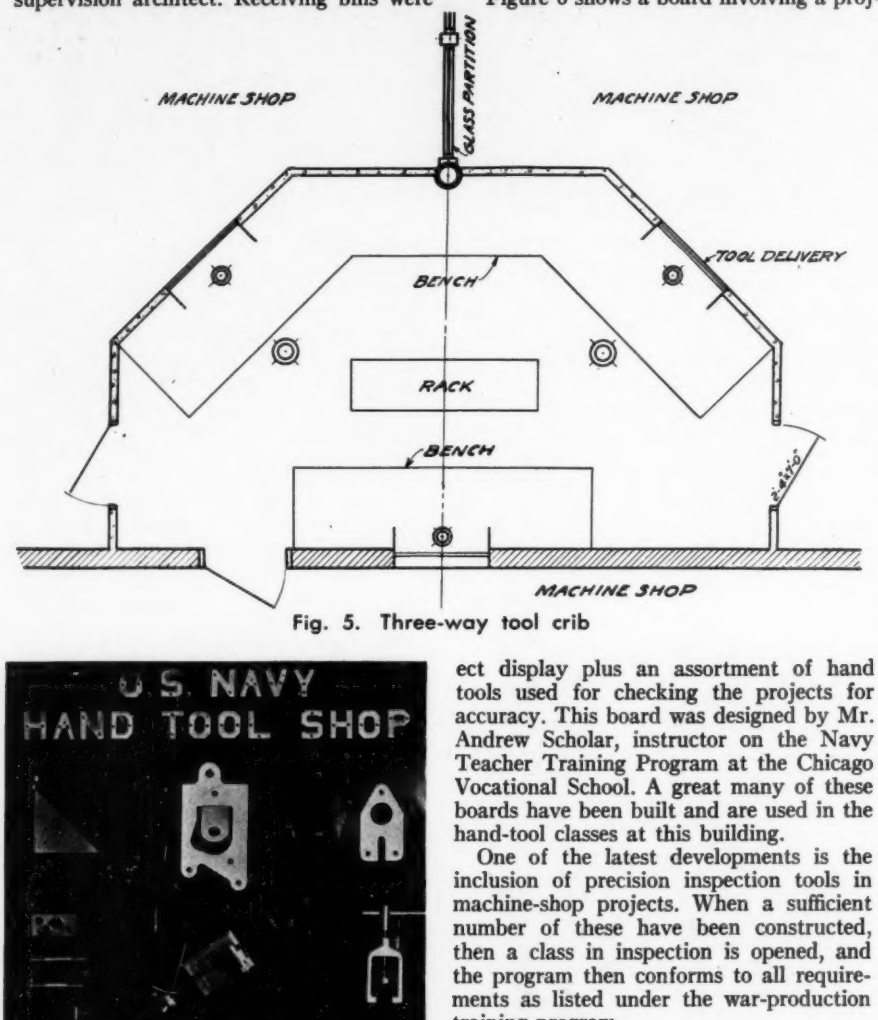

Fig. 5. Three-way tool crib

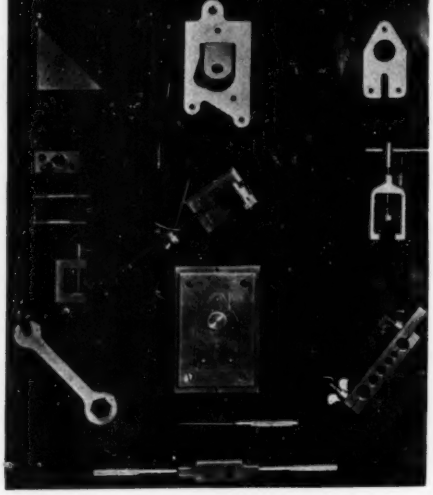

Fig. 6. A display and tool board

One of the latest developments is the inclusion of precision inspection tools in machine-shop projects. When a sufficient number of these have been constructed, then a class in inspection is opened, and the program then conforms to all requirements as listed under the war-production training program.

We feel that this is a good start, and that as restrictions present themselves, we will be able to overcome obstacles through further adoptions of these units. Just what confronts us cannot be foreseen, but in the light of what we have been able to accomplish thus far, we feel sure that our program can continue for the training of schoolboys, war-production workers, and any auxiliary training program that might be required.

WE CAN'T FOOL A BOY

It's possible for us it seems
(In case we "lack the stuff")
To make a go at getting by
On nerve and empty bluff:
At that, a heedless world may laud
The "technique" we employ;
And we may fool our precious selves —
But we can't fool a boy.

I'm sorry for the teacher chap,
(If such there is) — who tries
To trick a simple, childish mind,
With inane words and lies:
Who doesn't deem it worth his while,
A lad's respect to share;
And bluffs because he "doesn't know" —
Or worse yet — "doesn't care"!

It seems that youngsters are endowed
With faculty to see,
The thing that bides within the heart
Of men like you and me:
And should we scorn the confidence
We're privileged to enjoy;
He'll guess it — all too soon, my friend —
For we can't fool a boy.

And should we pause beside him
As he toils with jobs or plan,
About the time he thinks — "I can't" —
And show him that he can:
We're bound to feel a keen delight,
And sense a warming glow
That only those who tell him true;
Can understand or know.

We'll find it pays to "play the game"
And look him in the eye,
When answering an — S. O. S.
On "how" and "what" and "why":
And if we don't — the day is sure
When pretense must destroy
Our chance for something rare and fine —
For we can't fool a boy.

— *Adam N. Reiter*

MY BOYS

My boys, they come in every day,
Some to work, and some to play,
And when I see a job well done,
I know that half my battle's won.

My boys, I watch them as they try
To get the best of this old guy,
But there's one thing that they don't know,
I used those same tricks, years ago.

My boys have faults, I know that's true,
But haven't I, and haven't you?
And if I could choose, right down the line,
I'd pick a group of boys — like mine.

— *Leonard E. Schmidt*
Lincoln Hall Vocational Shops,
Lincolndale, N. Y.

Steps in Teaching a Lesson*

ROY E. HOWARD**

The daily lesson is the most important means of achieving the objectives that have been established for any course. The ability to teach an effective lesson is one of the important requirements in good instruction. The instructor, in teaching the lesson, must know what to teach and he must bring into use an understanding of the principles of learning. The daily lesson in the Armored Force School is doubly important because there is so little time to teach the many things that must be included. For this reason the instructor must understand well the steps to go through and the procedure to follow in his daily teaching.

Four Basic Principles in Presenting a Lesson

1. The instructor must understand the learner. The successful instructor understands and applies the psychological principles and laws of learning. With the principles and laws in mind he selects the experiences he wishes his students to have during each lesson. The success of the student depends considerably upon the instructor's clear interpretations and understanding of how people learn their emotions, feelings and attitudes, individual differences, the problem of intelligence, reasoning, interest, and how best to present the various types and kinds of subject matter.

2. The instructor must know what to teach, and the learner must know what he is expected to learn. If the work has been fully analyzed so that each unit is listed and broken down into instructional steps, the instructor will have an outline of what to teach and the student can be definitely told what he is expected to learn. The outline of instructional steps forms the basis for a lesson plan.

One instructional unit and no more should be taught at one time. Teaching how to clean and adjust a spark plug is a single fundamental procedure and should be taught as such. Teaching how to clean and adjust a spark plug, and at the same time, the fundamentals of electricity, complicates both units and tends to confuse the students. It is far better to teach how to clean and adjust a spark plug after the fundamentals of electricity have been taught. Each forms a unit of instruction that requires careful and deliberate preparation in order that it may be presented simply and directly.

Fryklund presents another point to consider when identifying what to teach:[1]

> It is not the seemingly easy operations that should be taught first. The basic and frequently used ones should be taught first whether they are seemingly easy or difficult. Individuals differ in every human characteristic including ability to learn readily the elements of a trade. What may be easy for one person may be difficult for another. Therefore, the question of difficulty as a control of the teaching order may be dismissed in favor of the frequency of use of a given operation.

Another reason for teaching the most frequently used operations first, is that they are usually fundamental to more advanced operations or jobs. Operations or units of instruction basic to advanced units or jobs should be taught first regardless of their seeming complexity.

Effective teaching necessitates telling the students what they are expected to learn. In manipulative work they must know the degree of skill and accuracy that the instructor expects of them. The aim of the student and teacher should be the same. The student should aim to learn what the instructor aims to teach. It is a good idea to place the aim or aims on the blackboard and definitely announce them to the class before each new lesson is presented. For example, the instructor in the motorcycle department would state the aim of the lesson in the following manner: "Today you are to learn how to clean and adjust a spark plug."

3. The instructor must know the best method of presenting a given lesson. There is not a best method of teaching to cover all situations. The objective, the teacher, the learner, the subject matter to be taught, the time limitations and the equipment and supplies available are the major factors in determining the best methods of teaching a given lesson.

Some of the common methods of teaching are: conference, demonstration, written instructions, discussion, recitation, lecture.

The instructor who is able to use a variety of methods in his teaching is in a position to bring about effective learning. A variety of stimuli (methods) facilitates learning.

4. The instructor must understand and use the many aids and devices that improve the effectiveness of teaching. There is always need for aids and devices that will help in getting the learner to understand fully what is being taught. Some of the common instructional aids are: charts, drawings, pictures, and sketches; films and film strips; slides; models; exhibits.

These aids will be considered in a future lesson.

Steps in Presenting a Lesson

The technique involved in teaching must be understood and mastered by the instructor. A man may be an expert mechanic or craftsman in a particular field and be a failure as an instructor because he has not learned and mastered the skills or techniques of teaching. The steps in teaching a lesson are:[2] preparation, explanation, demonstration (presentation), application, tests and examination, discussion.

The framework of these steps may be traced to the educational philosopher, Johann Friedrich Herbart (1776–1841) and to his followers. Herbart stressed four essentials in the learning process: preparation, presentation, application, and testing. To be sure, they are theoretical steps, but they have value in analyzing a teaching and learning situation. The following paragraphs describe the six steps that are followed in teaching a lesson. The descriptions are adaptations of material presented in "Basic Field Manual, FM 21–5, Military Training":

1. *Preparation* — There are two aspects to preparation:

a) The instructor should have well-prepared instructional plans and materials.

b) The instructor should prepare the learner for a given lesson.

The instructor must know well the subject that he is to teach. He must analyze the subject and the schedule that is to be followed, considering the purpose of the subject and the essential facts that must be taught. He must select the information and skills to be taught, texts to be used, equipment, and aids to instruction that will be needed. The essential facts should be arranged for presentation in logical and progressive order. This is the step that makes trade and job analysis a necessity. The analysis is the inventory of the essential elements that can be taught. From it the instructor selects the units of instruction that are to be covered. He then prepares his specific lesson plan for each instructional unit.

Preparing the students' minds for the reception of the new lesson is the second aspect of preparation. It is arousing interest and purpose. If the student's interest is aroused he is usually receptive to instruction. If he is disinterested or not ready to learn, he tends to learn little. Interest must be aroused if the most good is to come from presentation of a lesson. The instructor's and the student's objective must be the same.

2. *Explanation* — In creating interest or getting the student ready to learn it is necessary that he understands at the beginning just what is to be learned and why the particular units of instruction are being studied. Lengthy explanations are not necessary. Comparison or contrast to those things which the student already knows are preferable to a long detailed unrelated discussion.

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*This is the second of a series of articles on presentation of lessons from staff members of the Teacher Training Department (Lt. Col. Verne C. Fryklund, director), of the Armored Force School (Brig. Gen. S. G. Henry, commandant), Fort Knox, Ky. Trade Analysis and Human Relations were taught in the school prior to teaching the content of these articles. The articles will not appear in sequence. Certain details referring to the military have been deleted.

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[1]Verne C. Fryklund, *Trade and Job Analysis* (Milwaukee, Wis.: The Bruce Publishing Co., 1942), p. 196.

[2]"Basic Field Manual, FM 21–5, Military Training" (U. S. Government Printing Office, Washington, D. C., July 16, 1941), pp. 22–24.

3. *Demonstration* (Presentation) — The most widely used technique for the presentation of a lesson in technical classes is the demonstration. The demonstrations are usually supplemented with visual aids, blackboard sketches, and the like. A demonstration of the subject or unit of instruction very often makes a more lasting impression than can be made by other means. The use of carefully rehearsed demonstrations simplifies instruction and aids the student in remembering the points brought out. Identical materials, tools, and equipment should be used wherever possible. The training films prepared by the Army to teach specific units of instruction are useful additional stimuli when used along with the demonstration. They may be shown in place of a demonstration or when it is not possible to perform the actual demonstration. For example, there may be certain lessons in *tactics* that cannot be conveniently demonstrated, but a training film can be substituted.

It must be understood, however, that when a particular lesson does not lend itself to the demonstration method, the conference, recitation, discussion, or lecture method should be substituted. It has already been stated that there is not a best method of teaching for all situations. It is true, however, that for shop and laboratory courses the demonstration method is perhaps the best means of presenting a lesson designed to show how to do something.

4. *Application* — The student must apply what he has been taught if there is to be any assurance of learning. By practicing the things in which he has received instruction, the student acquires further knowledge through actual performance and develops skill by repetition. If a doing unit of instruction has been demonstrated, it should be used as soon as possible by the learner in a situation similar to that found in the field.

The learner should be able to apply what he has learned, and he should develop confidence in doing it. The teacher should follow up the learner during application to see that he really understands a process or an operation and explain it properly. He must allow the student time, however, to attempt to apply what he has been taught. He must not be too quick to assume that help is needed; there must be time to try. The help given must be limited to clarifying details which are not understood or learned or which are not applied properly.[3]

5. *Tests and Examinations* — If the instructor wished to determine how well the learner knows what has been taught, a testing program must be set up. Tests have a twofold purpose.

a) To review the essentials of the subject of instruction, thus impressing them on the mind of the student.

b) To determine whether the student has the requisite knowledge and the ability to apply it.

The tests or examinations may take the form of written or oral answers to questions, of applications of doctrine or of performance, demonstrating certain required phases of drills, exercises, or mechanical techniques. Performance tests should be used whenever practicable.

6. *Discussion* — The purpose of discussion is to sum up and clarify the important points of the subject that have been developed in the previous steps. In the discussion, the instructor points out correct and incorrect methods of execution and makes uniform the general understanding of the subject or lesson. The discussion may take the form of a conference. At the conclusion of an applicatory tactical exercise, discussion is generally called a critique.

What Is the Place of Questioning in Teaching a Lesson?

Questioning deserves first rank among the teaching devices designed to provoke thought and to stimulate students to profitable activity. The ability to question effectively has been called one of the chief prerequisites of good teaching.

What Are the Purposes of Questioning?

Questions and the questioning technique will be used to advantage during each of the six steps followed in presenting a lesson. In the preparation and explanation steps, the instructor, by questioning, discovers the interests of the learners and the special abilities of individual students that may be developed. Through oral or written questioning he learns what knowledge already is possessed by the students. Questions skillfully asked at this stage arouse new interests and direct attention to the proposed lesson. They aid in setting the extent of the lesson and suggest sources of information and activities.

The purpose of questioning at the end of a presentation or demonstration is to summarize and "clinch" the main points brought out in the lesson. Questions are also used to prepare the student for the application of the lesson.

During the application stage of the lesson the questioning technique is valuable in helping the student to do such things as plan his work, determine the equipment needed, solve problems, and the like. If the student is to learn to solve problems, he must be given practice. By asking questions the instructor can direct the student's thinking without actually solving his problem.

In testing and discussion steps of teaching the lesson the question plays a leading role. Questions are used in this phase of teaching more than any other device. The questions may be either oral or written.

What Are the Characteristics of Good Questions?

The exact nature or type of question to be used varies according to the purpose that is to be served. The questions asked during the preparation stage and the explanation of a lesson can partially suggest the correct answers. In the testing stage no suggestion as to the correct answers should be given if a true measurement is expected. A good question should be clear, brief, understood by the students, challenging, stated to make it possible to bring about the desired reasoning for which it is intended, and so stated that all pupils are required to think and reason.

Established Practice in Questioning

Fryklund suggests that the following points should be followed in asking questions of a student or class:[4]

1. State the question clearly. Questions in shopwork are usually related to the *why* and *how* of a problem.
2. All questions should be answerable. It is unwise to ask questions merely to bring out a learner's ignorance. However it is not out of place to ask a question of an inattentive person to get his attention.
3. Ask questions of the class as a whole. After a pause, single out an individual for the answer. This keeps the group alert.
4. Do not permit group answers.
5. Every question should presuppose a previous experience that will enable the learner to answer.
6. Encourage complete and clearly enunciated answers.
7. Do not permit a few persons to answer all the questions. Hold all the class to account by permitting each member to take part with reasonable frequence.
8. Questions that can be answered *yes* or *no* should be used sparingly.

These points give instructors four steps to follow in asking questions: instructor asks question, pause of a few seconds, individual student is called on to answer the question; student answers the question.

Summary

In presenting a lesson the instructor should know and understand the students. He must know what to teach and the students must be told what they are expected to learn. He must also know the best methods and devices to use in presenting the lesson. The lesson to be taught is comprised of units selected from the analysis of the trade or subject. Only one doing or knowing unit should be taught at one time and the most fundamental and frequently used units should be taught first.

The method most widely used in the army to present a lesson is the demonstration. Other methods such as the conference, lecture, written instructions, discussions, recitations, and practical work also play an important part. The steps in teaching a lesson are: preparation, explanation, demonstration (presentation), application, tests and examinations, discussions.

Questioning, both by teacher and the student, should be used throughout the entire lesson. There should be a well-defined purpose upon which to base all questions. By using the questioning technique the students are given a chance to participate. Questions tend to stimulate the students more than when facts alone are presented, and he responds with greater interest and learning.

[3] Verne C. Fryklund, *Trade and Job Analysis* (Milwaukee, Wis.: The Bruce Publishing Co., 1942), pp. 130–131.

[4] *Ibid.*, p. 132.

Vocational Education and War-Production Training

WALTER J. BROOKING*

Today America is looking toward industrial education. Hundreds of thousands of men are being called from their normal peacetime work to military service. The conversion of American industry to war production has thrown an unprecedented burden of readjustment and industrial training upon industry. The curtailment of much peacetime manufacture of civilian goods has released thousands of workmen from ordinary jobs who must be trained and established in some phase of wartime production.

The need for vocational training for these men is urgent. It must be done effectively and as quickly as possible. Many of these men have never worked in factories before. The age variation within the groups is wide, ranging from boys just out of high school to men up to 60 years of age. The immediate problem is to give these men sufficient training so that they may take some sort of an industrial job as soon as possible and with as little disruption of industry as possible.

This burden of training must be borne to a great extent by industry itself because of the very nature of the training which must be done. However, the vocational departments of many public schools are making a contribution of great importance to this training program. The most significant part of their contribution is that they are using their physical facilities and their personnel in many cases to remove the elementary phases of this training from the equipment and man power of industry and placing them in the schools. This releases the much needed industrial equipment which may have been used for training of new men for actual production of war munition and supplies, and allows industrial training forces within the factories to devote their attention to men who have had a certain degree of training in the elementary phases of the work which they must do, thereby allowing a larger number of men to be assimilated into industry.

A good example of how the vocational-educational department of a city school system is giving real assistance to this national emergency training of industrial workmen is the program as it is being carried out by the Peoria school system of Peoria, Ill., in cooperation with the Peoria industries, notably R. G. LeTourneau, Inc., manufacturers of heavy earth-moving equipment.

This school system had an active and progressive vocational-education training program in action at the beginning of this period of national crisis. Shortly after national defense education funds were made available, to be administered through the state board of vocational education for national defense, the Peoria school system expanded their vocational-educational program to include night school classes for industrial workmen in blueprint reading, machine tool operation, machine drafting, shop mathematics, patternmaking, and other subjects which they were prepared to offer because of equipment and teaching personnel.

This program was attended with immediate success. Classes were filled to capacity with men who needed additional training, some of whom had never worked in factories, while others needed some additional phase of training to take a better job than the one they already had. Judged by the only criterion by which such a program may rightfully be judged, that of men placed in industry, or upgraded in their jobs because of such training, this program was attended by considerable success.

Early last summer the program was experimentally and cooperatively expanded. The management of R. G. LeTourneau, Inc., and the director of vocational education in the Peoria schools envisioned a plan which would speed up and make more effective the training program which the LeTourneau Co. had been carrying out, and by which the greatly increased number of workmen being absorbed into the company's expanded program of production could be trained in the city's public school buildings.

Because the company's pay roll has grown from five or six men in Peoria in 1935 to approximately 2000 in the early summer of 1940, a well-developed plant education system had been built up by the company. This was largely carried out in the form of *on-the-job* training for workmen desiring to learn to weld, to be flame cutters, machine tool operators, or other such occupations. In addition to this *on-the-job* training, there was a rather complete series of home study courses, based on a good textbook with questionnaires which were answered at home by the workmen covering the theoretical phases of the workman's job. These home study courses were given in shop mathematics, blueprint reading, machine tool operation, arc weld-

*Director of Plant Education, R. G. LeTourneau, Inc., Peoria, Ill.

Machine tool operators who spend one night a week in the machine shop, and one night in a regular classroom

Workmen in the flame cutting and acetylene welding class

ing and welding symbols, flame cutting, acetylene welding, and the fundamentals of leadership. These courses could be completed by the workmen as quickly as they desired to complete them. On the average the theoretical home study courses in any subject were completed in from 20 to 52 weeks.

Cooperative Plan Put Into Action

In order to bring the supplementary theoretical training covered in the home study classes to the men in the LeTourneau plant already on the job in a more complete and much quicker manner, the following plan was envisioned. Regular classroom classes held in the high school building were set up for each of the home study classes taught by the LeTourneau Co. A foreman or supervisor from the LeTourneau plant who qualified to teach these subjects was selected and certified as a teacher of that particular defense school training class and this theoretical training was placed on a classroom basis. The actual administration of these classes was under the direction of the Peoria vocational education director, Mr. L. P. Elliott, who was assisted in the actual establishing and supervision of these classes by the director of plant education for the LeTourneau Co.

Under this cooperative plan, classes of men who worked at the LeTourneau plant and others from the community who were interested, met in the classrooms of one of the Peoria high schools for three hours each night for two nights a week for a period of 10 to 12 weeks, during which time they studied the subject matter covered by the home study classes taught by the company. The cost of administrating the classes, the building maintenance and janitor expense, and the hourly pay for the instructors was paid from funds made available from national defense education appropriation allotted by contract for each of these courses.

These classes under this cooperative program have been remarkably successful. In the first place they shorten the time required to cover this theoretical work to perhaps one quarter or one third of the length of time required by the old system of home study. A second important feature of these classes is that they are set up on a teacher-student basis, where the teacher is a skilled workman or supervisor of a part of the men in the class and where the many advantages of classroom presentation may be used in teaching the class. In this way blackboards may be used for diagrams, questions may be asked and answered, phases of subject matter which are related but which cannot be covered well in home study classes may be described and explained by the teacher-foreman in a classroom presentation.

Another advantage of this classroom association of workmen with their supervisors is that frequently a supervisor will discover capacities and abilities in the men in the class which he had not discovered on his day-to-day job association with the man in the shop. In a like manner the men in the class frequently came to recognize the supervisor who was teaching the class, not only as a skilled workman but as a human being with certain qualities of personality and leadership which permits their association to be more productive and more cooperative on the job.

The men in the classes who come from plants other than the one from which comes the foreman-teacher and the majority of the students, bring their contribution of different ideas and different ways of doing things to the class and take back to their organization helpful suggestions as well as organized training which they can apply to their own work.

As a means of preparing industrial workmen for better jobs by increasing their skill and by teaching them related theoretical phases of the work, this classroom teacher-student association has great advantages. It has been found that these men who have acquired additional training, are able to do their work better, or to assume the responsibilities of larger jobs to which they may be assigned. In this way, the training has been found an effective means of upgrading the men on the job and of making way for new personnel in the industry.

Important Contribution of Public School System

The contribution of the Peoria school system to this cooperative method of training is a very significant one. In the first place, from a purely administrative standpoint, the classroom with the instructor and student could be set up on the premises of the factory. Actually, in some cases this is done, but the problem of finding space enough to make a satisfactory classroom, and furnishing it with desks, chairs, blackboards, and other equipment such as is already in the public school buildings, would be a very difficult one for most industrial establishments, especially in these days of expansion of activities and personnel. Further, the furnishing of adequate lighting, heating, ventilating, and toilet facilities for such a room, or group of rooms required for such classes on the factory premises would almost of necessity require the expenditure of additional money and the loss of time in waiting for installing the equipment. All of these items the public school systems have, and in addition they have certain expensive items of physical equipment for some classes which can effectively be used in training men for war industries which ought to be so used. Notable examples of this type of equipment are the machine tools in the machine shop, the woodworking and patternmaking equipment, and other such equipment that lends itself to work which men are learning to do for war industries.

In the case of the machine tool operation course, both the LeTourneau Co. and the vocational education teaching force of the Peoria high schools benefits by the program. It was found that the purely theo-

retical teaching of machine tool operation subjects taught to men who are actually operating machine tools most of their time during each day was rendered more beneficial by spending half the time, that is, one three-hour period each week, in studying from a textbook and then spending the other night in the high school machine shop under the supervision of the regular high school machine-shop instructor. Both the high school instructor and the class at large profited from this system, which is now in operation and has been for the past six months. The variety of machine tools in the high school machine shop allow some men in the class to work on machines which they do not normally work on in the factory and thereby learn the operation of a larger variety of machine tools. The regular high school instructor by his contacts with these men who are actual machine tool operators finds the experience helpful and inspiring in somewhat the same way as if he was actually working in a factory himself. The members of the class can profit by his expert teaching practice; and by contact with both him and their own foremen as instructors many things are covered which might otherwise be missed.

The presentation in these night school classes seems to have been satisfactorily correlated with the regular daily teaching activities of the school. The response of the men attending the night school classes to such restrictions as *no smoking* and to requests for care of the equipment and furnishings in the regular classrooms has been satisfactory. As long as such restrictions are sensibly and clearly explained, it has been found quite easy to get the students' wholehearted cooperation.

The members of these classes do not seem to be reluctant to come to a school building and sit in a formal class where they learn the finer points of their job, but rather seem to respond to the orderliness of the school atmosphere of the classes with a more serious pursuit of their own personal education. This factor alone is of real significance from the standpoint of the vocational school and of existing industrial relationships.

These Classes in Addition to — Not Instead of — Regular Vocational Night School

The classes just described are not run to the exclusion of other war production training classes, but rather in addition to them. The classes for men who are not working in any industrial setup, taught by regular high school vocational teachers as night school subjects, are being conducted as they were before this special program was worked out between the school system and the LeTourneau Co. During the months of October through December, 1941, over 15,000 hours of classroom study work was accomplished by men in these cooperative classes. This represented only a part of the war-production training effort being made by the Peoria high schools, but it represents a very important part which uses only such classrooms and equipment, most of which would not otherwise be used for night school instruction. Since the buildings were already open and janitor, light and heat, and supervision costs were already being borne for existing night school classes, the addition of these cooperative classes only served to make more effective the very considerable and extremely valuable contribution which the public school system is making to the present national emergency.

A wide variety of subjects may effectively be taught in this manner. The fact that the industry is supplying the majority of the members of the classes and also the instructors, requires that they also supply the outline of the subject matter for the class and be responsible for its presentation. During the nine months which these classes have been conducted, classes in the following subjects have been completed under this program: machine tool operation, blueprint reading, elementary shop mathematics, arc welding and arc welding control by symbols (theory), flame cutting and acetylene welding, elements of inspection, first aid and factory safety, fundamentals of heat-treating practice, time study for foremen and supervisors, industrial photography, mechanical and electrical shop maintenance, and surface layout and template development.

Several of these classes have been conducted entirely at the plant, yet under the administrative supervision of the director of vocational education in the Peoria schools. Such classes as flame cutting and acetylene welding, and mechanical and electrical shop maintenance, must be taught at least part-time in the shop. All such classes must be maintained on a thoroughly practical basis. This means that the director of plant education in the plant in which the cooperative plan is working must correlate the subject matter of the class with the shopwork being done in the plant.

Textbooks are used in almost all of these classes, the mechanical maintenance class being the only exception. The textbook must be general and should be as comprehensive as possible. It must serve as a general outline of the subject matter to be taught and upon which the practice of the individual plant may be superimposed during the teaching process. The teaching of the maintenance classes is different. Most maintenance men learn by taking machines apart, examining them, repairing them, adjusting them, reassembling them, and operating them. The process of learning by reading is laborious and is not the most effective means of learning about the details of machinery. For this reason this class devotes its entire time to the study of separate machines or groups of machines throughout the course. The attendance and interest of the students was remarkable. A class of this kind must of necessity be conducted on the premises of the factory in order to allow the men to study the specific machinery and equipment of a given plant.

High school teachers who are teaching these and related war-production classes in night schools seem to find the experience interesting and somewhat different from their regular work. There are certain differences which are rather outstanding. One is that the emphasis on grades and examinations is very much less than in the ordinary high school level vocational-training program. The important thing in these

A class in elements of inspection and another in blueprint reading

classes is not a recitation nor a grade on an examination but rather the effective learning of some phase of subject matter which the man may take with him to either get a job in present wartime industries or to better himself on the job where he is already employed. That is the criterion by which these courses must be evaluated and consequently the emphasis on grades and examinations are somewhat reduced. Hours of class attendance and attitude seem to be more important than grades.

The contribution which can be made to our present national emergency training program by a public school system, especially by their vocational department, is very significant. Participation by a public school system in this type of training will in all probability produce a program of mutual betterment for industry and for the public school system. The development of a vigorous and effective cooperative program of this kind not only offers a timely and effective solution to a present vital need for vocational training of industrial workmen, but seems likely also to lay the foundation for effective cooperative public school vocational education and industrial relationship in the future.

In-Service Training of Vocational School Teachers

RICHARD M. DRAKE*

In a recent report the Educational Policies Commission[1] stated that, "The supply of teachers for vocational subjects is already inadequate and it is necessary to recruit such teachers of temporary certificates from the ranks of skilled workers. Teacher-education institutions . . . might well provide special in-service courses for such teachers in order that they may become more effective in the training of defense workers." The vocational schools in Buffalo and the surrounding area are among those which have been hampered by the shortage of teachers and have had to draw men from industry to teach on a provisional basis.

In the fall of 1941 the writer inaugurated at the University of Buffalo an experiment in teaching procedure called "A Laboratory in Curriculum Problems of Vocational Schools." This class was designed primarily for in-service training of the provisionally certified vocational school teacher. Rather than employing a course of study determined in advance, the group attempted to organize the work according to general and specific problems introduced by the members and growing out of their teaching experience. The class members worked as committees on the general problems and individually on the specific problems. Some of the general problems chosen by the group were:

1. Selection and advisement of students.
   - *a*) What are the best bases for the selection of entering students?
   - *b*) What criteria and procedures are useful for continued advisement of the students after they have been selected?
   - *c*) Does the school have a responsibility for the student after graduation?
   - *d*) What sort of guidance should the students have previous to selection?
2. Organization and administration of the school shop in a program which extends beyond the regular school day.
   - *a*) What are the best procedures for taking care of tools and other equipment?
   - *b*) What are the responsibilities of the teachers in the various shifts?
   - *c*) By what means should men from industry be inducted into teaching?
   - *d*) How should the course of study be organized in order to enable efficient use of materials and facilities?
3. Safety in the shop.
   - *a*) What are the sources and causes of shop injuries?
   - *b*) By what means can students be taught safety?
   - *c*) How can the school shop discover and make use of the experiences of industry in overcoming hazards and preventing accidents?
4. Placement and follow-up of graduates.
   - *a*) What techniques or devices can be used?
   - *b*) What are the benefits accruing from such activity?
   - *c*) How can the work be co-ordinated with that of agencies serving in a similar capacity?
5. A study of factors relating to students who leave before graduation.
   - *a*) Why do they drop out?
   - *b*) Where are they and what are they doing?
   - *c*) What are the implications for the curriculum of vocational schools?

The more specific problems concerned the organization of instructional materials and methods of teaching in certain narrow areas.

The students obtained aid in studying their problems from various sources. Group discussion proved very stimulating. Special speakers were scheduled during the semester upon request by the group. For the most part, these speakers contributed to a better understanding of the more general problems and thus added breadth to the work. The following people were scheduled speakers:

1. A specialist in methods of teaching.
2. A school counselor.
3. A shop safety expert from one of the local armament plants.
4. A teacher of industrial arts.
5. A school administrator.
6. An industrial personnel director.
7. A director of vocational education in a public school system.
8. An instructor in the field of tests and measurement.

A small classroom library was organized. The materials related primarily to vocational education and oftentimes were contributed by members of the class. The students were encouraged to do outside reading and to report back to the class on articles and books which they felt would be of interest. Ample opportunity for individual and group conferences with the instructor was provided.

The laboratory differed also from the traditional class in certain administrative aspects. The meeting was scheduled for a 3½-hour session each Saturday morning. This extended period made it possible to carry on some activities not easily adjusted to a one-hour session. It also allowed for flexibility in planning. An attempt was made to create an informal atmosphere by having the group seated about a large conference table and encouraging freedom of expression at all times. The members of the group were organized into the following committees: (1) Planning, (2) Library, (3) Educational trips, and (4) Social.

In order to synthesize the work of the class, the groups that were working together on problems reported their findings to the entire class. These were discussed and revised in the light of the class criticism. The instructor then edited the papers and provided each member of the class with a mimeographed copy of the entire proceedings.

It is apparent that the principles under which this group operated allowed for con-

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[1]Educational Policies Commission, *A War Policy for American Schools*, Washington, D. C., Feb., 1942.

siderable responsibility and initiative on the part of the members. The instructor's position was largely that of a guide and co-ordinator. It is not essential that he be a specialist in vocational education but it is desirable that he be well versed in the broad principles of education. It is also helpful if the instructor has a background in science and mathematics.

The evaluation of all the outcomes of such a teaching procedure is an impossible task. However, the instructor attempted to appraise the reaction of the group by having them list recommendations and commendations. This was done by the entire class working together in the absence of the instructor. Their recommendations were:

1. More speakers from various educational fields.
2. A more extensive classroom library.
3. Expansion of the class to include in its membership more related subject teachers and also nonvocational teachers.

The following commendations were set forth by the class:

1. Informality of the course was refreshing and stimulating.
2. Concise summarizations by the instructor were very helpful.
3. Critical, friendly attitude of the members of the group during discussions served to temper extreme statements made by members.
4. Variety of problems gave breadth to the course.
5. Students were treated like adults rather than grade school children.
6. Inviting in speakers from various related areas was one of the high lights of the work.

The reaction of the writer was that if the members of the class profited as much from the experience as he did, then the experiment has indeed proved its worth.

Selection of War-Production Training Instructors

NELSON HAUER*

Tradesmen, journeymen, and mechanics have enjoyed varying degrees of popularity during the past 200 years, but it is questionable whether the demand for them has ever been as great as at the present time. It was not uncommon in the early colonial period to offer the skilled worker a profitable bonus as a special inducement to come to this country. Quite often he was respected as much as the most prominent citizens of the community.

Later, during the industrial revolution and the cyclical boom periods of the nineteenth and twentieth centuries, the skilled craftsman again was in great demand to help turn the wheels of industry. Today, the tradesman is no doubt the idol of the industrial world.

The sudden demand for trade teachers to meet the needs of the war production training program soon absorbed the reserve supply of tradesmen with professional training. This was especially true in Louisiana. Like other states, we began to fill teaching positions with the best hand-picked tradesmen available. It was necessary in the beginning to go into industry and seek them out — like searching for missing persons in a large metropolis. As the training program developed, the enjoyment of teaching became better known among these mechanics, and the reserve supply of applicants for teaching positions increased, so that some degree of critical selection became possible.

Selecting a journeyman to teach a trade is considerably more than rating trade experience, for a teacher of shop subjects must have definite qualities. For instance, he must be able to get along easily with people, he must know his trade well, and he must know how to manage a shop. Getting along with people requires that intangible something called *personality*. Everyone has a certain amount of it, but an instructor should radiate an abundance. He should have the kind of personality that is magnetic and attracts the admiration of trainees immediately. He should be a kind of regular fellow — a "he man" — in the parlance of shopmen.

Regardless of how well a craftsman knows a trade his success is limited as a teacher if the men or boys do not respect him. On the other hand, if the trainees have confidence in the instructor's ability to lead them out of the darkness of industrial mysteries and into the light of understanding and craftsmanship, they will exert more effort to try and learn.

In addition to having skill, the instructor must be able to interest others in his craft. Skill and knowledge very often are like commodities that have to be sold to the prospect, since the innate desire to buy a product or to learn a skill is not always existent with everyone. Few ever buy from a salesman whom they dislike from the first meeting. The same is true of an instructor who does not appeal to his students.

Of course, one might say that the commodity or trade will sell itself, which may be true occasionally.

Besides possessing a reasonable amount of trade skill, the tradesman instructor should hold the respect of his fellow craftsmen.

Trade ability in no manner should be judged by the number of years of trade experience. For "as one may have lived in a city a hundred years and never have grown a day," so many a tradesman may have worked years and gained very little experience. Fifteen years' experience in a small shop that specializes in only a few branches of the trade is of little value in comparison to seven years' experience which covers all fields of the trade. Then, too, the fact that a journeyman has worked in several shops may be of particular value in rating for teaching, even though this practice is quite often discredited by school administrators because it suggests that the man may have been a *floater*.

However, it may also be interpreted to mean that a man who has worked successfully for several employers has better demonstrated his ability to get along with people than the man who has worked for only one employer. Every mechanic knows that trade practices vary in different shops and moving about is one way of learning these practices.

In listing trade experience, the title of *foreman* is considered a coveted prize. If the applicant for teaching has been a true foreman, in the modern sense of the word, his experience should prove an invaluable asset toward teaching. Foremanship indicates an understanding of human nature, the way people work, and the ability to lead and organize. However, the administrator should not be blinded by the glare of titles, for there are different kinds of foremen. Some are mere pushers, others real foremen.

The one drives his men, while a real foreman works with them, and the men enjoy working with him. As to the percentage of each in industry, fortunately the pusher type is rapidly vanishing.

There can be little question that the teacher of today works with his trainees, whereas the domineering pusher belongs to that ancient era when the hickory stick reigned supreme as a teaching device.

Surprisingly enough, the average journeyman, without any professional training, has rather practical ideas about teaching. His ideas are not as well organized nor as fully developed as a trained instructor with teaching experience, but he does know

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about trade standards, craftsmanship, and employer-employee relationship. Also, the journeyman has the memories of his experience while serving as an apprentice and learning the trade. If the journeyman has had all-round experience, he knows that some helpers or apprentices learn faster than others; that it is often necessary to explain things to the helper and show him how to do certain tasks which, in a sense, is teaching. All these factors help the beginning shop teacher to do a fairly acceptable job of teaching.

The beginning untrained instructor, judging by your experience, does not have a clear understanding about the following responsibilities:

1. Shop organization and management.
2. The difference between telling and teaching (also a characteristic of many teachers of long standing).
3. An understanding of the learning process.
4. Group instruction.

One of the greatest weaknesses of the beginning instructor is in not knowing how to organize and manage a school shop. For some inexplicable reason the average journeyman has failed during his experience to gain a full appreciation of shop organization and management. He needs to be informed about shop layout, including arranging machines, bench areas, work areas, safety, storing supplies, housekeeping, and ordering supplies and equipment.

The average journeyman when in industry will plan a job with meticulous care in order to use the least amount of materials. When he becomes an instructor the use of materials often becomes of remote importance until it suddenly appears that the term's supply is rapidly vanishing.

Welders, who for years have been burning rods within 2 in. of their length, habitually permit trainees to throw away rods from 4 to 6 in. long. In sheet-metal shops it is not uncommon to see full sheets cut up with little forethought. Similar practices are true in other types of shops as well.

If the instructor is asked about faulty practices occurring in his shop with reference to a particular trainee, invariably he will say, "Well, I have told him how to do it several times." There can be little doubt that he is telling the truth, for many instructors do not know the difference between telling and teaching.

Since many mechanics learn their trade through observation and being told to do the job, their teaching methods follow the pattern of telling and showing. This is true of teachers of long experience and training, in many cases, as well as untrained, beginning teachers. They do not know that teaching is not telling, but helping one to learn and to understand the reason for doing the task a particular way. Telling and showing are only incidental to the learning process.

Real teaching can be done by anyone who has the will to teach. The factors involved are few. Basically these are: an insight into human nature, an understanding of the laws of learning, and a knowledge of the subject to be taught.

Helping trainees to learn requires an understanding of how they learn, a knowledge of their individual differences, and the ability to apply the principles of teaching.

Thorndike's laws of learning and the principles of Gestalt, together with the other schools of thought, may be applied to shop teaching as effectively as to classroom teaching or wherever teaching takes place.

In learning, there is the association of ideas, assimilation, repetition, correct practice, and not just doing a job or completing an assignment. Teachers too often teach subjects instead of students.

While war production training is largely specific job training requiring individual teaching, the opportunities for group instruction are frequently overlooked. In industry the worker is considered as an individual only to the extent of his performing the job successfully; otherwise, he is a member of a working group.

All machine-shop operators have much in common regarding the knowledge of metals, general safety practices, and group working. In the welding shop there is information about rods and generator control that is common knowledge and may be given through group instruction to all kinds of operators. Similarly with other trades, there is certain information that all craftsmen should know.

Since the length of time for training on the war production training program is limited, the instructor who plans his work will find that group instruction may be used to considerable advantage.

Since this war production training is an emergency measure, the training of the newly employed and often untrained instructors also is something born of the needs of the moment.

The general practice during the past year was to have the instructor spend the first week of his employment in observing and assisting an experienced instructor in a shop that was well organized. While the length of time was comparatively short, it helped the prospective instructor to make a partial adjustment to his new duties. Each instructor was given a prepared course of instruction in his trade to facilitate better teaching. Usually the trade school director or one of the defense program supervisors explained how the course could be used in teaching the trade. From the beginning of employment, all the instructors were given close supervision by the local supervisor and program director.

In addition to the help given by the immediate supervisors, a program of in-service training was conducted under the supervision of the state director of war production training.

The program of in-service training consisted of two parts: intensive training and close supervision by the teacher trainer. It was thought that the greatest amount of help could be given to the instructors by assisting them with their problems while in the shop. Also, it was our experience that the best way to determine the problems of these instructors was through close observation while they were in action.

The plan of in-service training provided for the teacher trainer to spend a full week at each trade school and training center having at least four or five shops. Since the shops often had three shifts, there were at least 15 instructors to be given training at each center which was well worth the full time of a teacher trainer for a week.

The teacher trainer spent as much time as possible with the instructors on the different shifts determining their problems, offering suggestions in teaching methods, and giving as much help to the instructors as possible. It was necessary, of course, for the teacher trainer to distribute his time so as to be able to visit all the instructors on the different shifts. Part of the week was spent with the day instructors and the remainder with the night and early morning instructors.

In addition to the shop visit, group meetings approximately two hours in length were held daily for the instructors. The instructors on the various shifts met either in separate groups or when it was possible, all together, depending upon the schedule of the different schools.

During the meetings as much professional training was given as possible, in addition to discussing the immediate problems of the instructors. The meetings were conducted informally and usually by the controlled conference procedure. The topics discussed most frequently during the meetings of the past year were as follows:

1. The objectives of defense training.
2. Shop management and duties.
3. Instructional duties.
4. How to make a trainee think for himself.
5. Interest factors.
6. Factors in developing skill.
7. Methods of instruction.
8. Individual differences.
9. Teaching versus learning.
10. Factor analysis of a teaching situation.
11. Lesson planning.
12. Analysis of a lesson.
13. Evaluating a lesson.
14. Characteristics of a skilled worker.

While some of the topics in the preceding list are suggestive of an extensive background of professional training, it is possible to present the subject matter in an interesting manner so as to be highly beneficial to instructors who are making their entrance into the teaching profession.

It may be suggested that tradesmen have a tendency to be materialistic and factual. Their interests are in cold, hard facts, and assistance that will be of direct help to their work. Tradesmen are, no doubt, justified in adopting such an attitude under existing circumstances, for theory and philosophy can be given when more time is available for reflective thinking.

High School Course in Construction and Maintenance of Model Airplanes

W. H. BOWERS*

The study of airplanes in Tuckahoe High School, Tuckahoe, N. Y., is started in grade one and continues through grade six. Actual construction of planes will be done in the industrial-arts department beginning in grade seven.

A high school course in airplane construction and maintenance is to be used as a unit in either grade 10, 11, or 12, the class meeting daily for one period throughout the year. It is expected that a student shall construct about 10 planes a year.

Related material, in topic form, will also be part of the year's work.

A close correlation will be enforced between this airplane activity and the high school regular course in general metalwork. Many of the students are enrolled in both subjects. In the latter class, fundamental skills are taught in sheet metal, machine shop, and benchwork, which are some of the basic skills required by workers in airplane construction and maintenance.

The basic projects in this elementary airplane model making are to give the pupil a mastery of five types of airplane models which can be purchased in kit form.[1] This should be sufficient to enable the student to make larger and more complicated airplanes later on.

It is hoped that the young men necessary for the protection of our nation will be influenced by these junior airplane activities and that the courses will be a contributing factor in giving young America a good understanding of airplanes for use in war and peace.

Objectives

1. To promote interest among high school students in aviation, both as to flying and ground maintenance of airplanes as a life vocation.
2. To provide the necessary steps involved in building and flying model airplanes, as a preliminary education in aeronautics.
3. To create a desire for acquiring skill and craftsmanship comparable to that existing in the airplane industry.
4. To stimulate interest in civil defense units.

Time Allotment

One period daily, 5 days per week (4 periods, model construction; 1 period, related work; for 36 weeks). Credit given for course — 1 unit.

*High School, Tuckahoe, N. Y.

[1]"Air Youth of America," 30 Rockefeller Plaza, New York, N. Y. See also Megow catalog, 217 N. Desplaines St., Chicago, Ill., and Oxford and Howard Sts., Philadelphia, Pa.

Processes and Operations for All Balsa Glider (Project No. 1)

1. Study plan carefully.
2. Lay out all materials on plan.
3. Sandpaper the wing sheet until all saw marks and loose balsa are removed.
4. Place sheet of carbon paper on wood. Pin printed plan over carbon paper and trace outline of one wing panel. Always trace each wing separately.
5. Cut along the outline on wing sheet.
6. Sandpaper the leading edge of each wing panel until rounded.
7. Cut wing strip in two; follow the assembly plan.
8. Elevate the tips to form dihedral (joining) angle.
9. Compute dihedral angle.
10. Level the inside or joining edges of the panels to match each other.
11. Cement panels (wings) together.
12. Cut out stabilizer and rudder.
13. Sandpaper both pieces so that leading edge of each piece is round.
14. Taper both pieces so that the trailing edge is narrow.
15. Sandpaper the rudder so that the taper from leading edge to the trailing edge of the wood will be equal.
16. Sand fuselage stick.
17. Cut along outline with sharp knife.
18. Sandpaper unit according to pattern.
19. Cut small V along upper surface of the stick where the wings are to be joined at an angle.
20. Cut slots in tail to hold stabilizer and rudder, with fine tooth saw.
21. Cement two wings together at proper angle.
22. Cement wings to fuselage along the V cut.
23. Cement rudder and stabilizer in the slots in tail of fuselage stick.

Miscellaneous Processes and Operations

1. Bending balsa wood.
2. Splicing balsa wood.
3. Constructing jigs to assist in assembling curved fuselages.
4. Attaching cross braces.
5. Holding stations together with rubber bands.
6. Carving nose blocks and propellers.
7. Heating bamboo strips.
8. Hinging ailerons to large model planes.
9. Inspecting plane after assemblage.
10. Removing surplus cement.
11. Attaching demountable wings with rubber bands.
12. Balancing wings.
13. Measuring models to determine wing areas and gross weight.
14. Attaching propeller to fuselage.
15. Adjusting propeller damaged through collision.
16. Constructing movable controls, such as the rudder, stabilizer, and fin elevator.
17. Making landing-gear parts, such as wheels, struts, and the like.
18. Building up a fillet with plastic, wood, or other medium.
19. Making fittings from piano wire.
20. Covering wings, fuselage, and the tail assembly of model planes.
21. Applying dope.
22. Applying bamboo paper, silk, or cotton fabric.
23. Applying antiblush on discolored dope.
24. Striping.
25. Enameling.

Tools, Materials, and Equipment

Balsa wood. Light in weight and color; grown in Central and South America.

Pine, basswood. For heavier outdoor flying models.

Rice tissue. Strong and light; comes in many colors; and used on rubber-powered planes.

Micro film. A thin covering for lightweight indoor contest models; very pliable; lighter than rice tissue.

Bamboo paper. Heavier than rice tissue, for gas models and large rubber models.

Silk. Sometimes used as covering for heavier models.

Cement. Used to fasten parts together; dries quickly.

Aircraft dope. A liquid applied to the paper of fabrics; used to stick paper to wood, or paper to paper; available in several colors; serves as a filler; strengthens the covering by causing it to shrink.

Rubber. Twisted rubber bands; used to power indoor models; spoils easily and quickly unless stored in metal containers.

Wire. Steel piano wire has great strength in proportion to its weight and size; used for fittings and propeller shafts.

Washers. Used to reduce friction between moving and stationary parts.

Aluminum and brass tubing. Used as a bushing or protector between moving and stationary parts, and for the hubs of balsa wheels. Also used for landing-gear struts and wing tips and around the propeller shaft.

Cellophane, celluloid. Transparent, thin; used for windshields and cabin windows.

Pliers or wire cutters. To cut piano wire.

Gas pliers. To hold wire in place while being bent.

Long nose pliers. To bend piano wire to shape.

Coping saw. To cut out forms.

Razor blades. To cut balsa wood.

Scissors. To cut out paper covering.

Knife. To cut out spars, ribs, and other parts.

Rulers. Used as guide for razor blades.

Pins. Used to pin parts to the plan or outline.

Hammer. Light in weight.

Drill. A small hand drill.

Clamps. Used to hold framework in position.

Carbon paper. To transfer outline to wood.

Workbench. Equipped with drawers and shelves for storage of tools and plane parts.

Miter box. To cut angles.

Related Material

Design

Period styles or designs of airplanes.

Blueprint reading.

Shop sketching.

Theory of orthographic projection.

Airplane drawings.

Mathematics

Bill of material computing cost of balsa wood, pine, birch, rubber, cement, dope, coverings.

Cost of different makes or types of planes; commercial, fighters, bombers.

Factors Controlling the Rate and Angle of Climbing

Horsepower of motors.

Cost of model airplane motors.

Science

Relative strength of different kinds of wood used in model airplanes.

Good contact necessary when cementing parts together.

Why an airplane flies.

Discussion of thrust, drag, gravity, and lift.

Proper care in storing rubber threads.

Design and shape of wings as basic factors to be considered in the construction of any airplane.

Construction of fuselage in relation to motor power stresses and the load to be carried.

Hardwood as used in the construction of the nose block for models propelled by heavy strands of rubber.

Effect of pressure upon the control system of an airplane.

Occupational Information

Brief study of the following industries, as to wages, working conditions, chances for employment, etc., as pertaining to the airplane industry.

Patternmaking.

Cabinetmaking.

Sheet metal (welding, riveting, and layouts).

Machine-shop practice.

The draftsman.

Drop-hammer operators.

Electricians.

Assemblers.

Skin fitters.

Pilot qualifications.

Army and navy pilot training.

History of Subject and Prominent Men in Field

Leonardo da Vinci (Italian).

Sir Geo. Cayley (English).

String Fellow, 1848 (first model airplane).

Adler, 1897 (French).

Prof. Langley (gliders), American.

Wright Bros. (American).

First airliner transatlantic passenger service flight, Capt. Grey, Yankee Clipper, 1939.

Fastest around the world trip.

Passenger trip, Mrs. Clara Adams, 1939.

Blind flying, Major McDaniel, 250 miles.

Glen Martin.

Igor Sikorsky.

Octave Chanute.

Glen Curtis.

The Maintenance of Aircraft

Mechanic certificates are required for those who intend to work for an airline or for an approved repair station (not necessary for factory jobs).

Mechanical training in the United States Air Corps.

Mechanical training in the navy.

Mechanical training in the army.

Employment Standards (Commercial)

Maintenance methods.

Mechanics in action.

General engine maintenance.

Routine engine service.

Safety

Dangers of fires and explosions when using gasoline in airplane construction and model airplanes.

Rules and laws in regard to low flying in crowded areas.

Precaution necessary when a crack-up in landing is certain.

Dangers involved when stunt flying.

Necessary equipment worn by a welder.

First-aid applications after welding burns are received.

Consumer Values

The possibility that cheap planes will be available to all, in the postwar era.

Present cost of a small commercial plane in contrast to an automobile.

Quantity production of private planes will be a big industry after war.

Why an Airplane Flies

Imagine an ordinary surfboard in the water. If you step on it, it sinks at once. If this surfboard is towed by a motorboat the front of the surfboard will be lifted up, out of the water. Why is this? The impact of water pressure against the bottom of the surfboard causes it to rise. Like the surfboard, the airplane takes off from a flat surface when the air rushing around and under the wing's surfaces creates a lifting surface equal to the gross weight of the plane. They both rise when traveling at high speeds because of the increased pressure under them.

The power that causes this lift in an airplane is its engine. The propeller blades, set at an angle, cut their way through the air with a sort of screwing effect.

The four forces that are most important in the design of any airplane are thrust, lift, gravity, and drag. Gravity is a pulling force of nature which tends to hold objects to the ground. Lift has been explained in the previous paragraph as applying to the surfboard and the airplane.

The Names of the Principal Parts of a Model Plane

Fuselage	Leading edge
Propeller	Wing tip
Nose block	Longeron
Landing-gear strut	Spreader brace
Wheel pants	Compression brace
Washers	Stringer
Wing	Covering
Rubber thread	Elevator
Ribs	Rudder
Inner spars	Fin
Trailing edge	Stabilizer

Glossary of Aeronautical Terms

Aeronautics. Science and art of flight.

Ailerons. A hinged or movable portion of an airplane wing the function of which is to give a rolling motion to the airplane.

Aircraft. Any weight-carrying device designed to be supported by the air.

Airfoil. Any surface such as an airplane wing, aileron, or rudder designed to obtain reaction from the air through which it moves.

Airplane. A mechanically driven, fixed-wing aircrafts, heavier than air, which is supported by the reaction of the air against its wings.

Airworthiness. The quality of an aircraft as to its fitness and safety in the air under normal flying conditions.

Altimeter. An instrument that measures the elevation of an aircraft.

Amphibian. An airplane designed to rise from and alight on either land or water.

Autogyro. A type of rotor plane which support in the air is chiefly derived from airfoils rotated about a vertical axis by aerodynamic forces.

Biplane. An airplane which has two main supporting surfaces placed one above the other.

Automatic pilot. An automatic-control mechanism for keeping an aircraft in level flight and on a set course.

Cabane. An arrangement of struts used for bracing an airplane.

Camber. The rise of the curve of an airfoil section.

Absolute ceiling. The maximum height above sea level at which an airplane would be able to maintain horizontal flight under standard air conditions.

Control stick. The vertical lever by means of which the forward and side control surfaces of an airplane are operated. The elevator is operated by a fore-and-aft movement of the sticks, the ailerons by a side-to-side movement.

Control surface. A movable airfoil to be rotated or moved by the pilot in order to change the altitude of the aircraft.

Controls. A term applied to the means provided which enable the pilot to control the speed, direction of flight, power, etc., of an aircraft.

Cowling. A removable covering usually around an engine or cockpit.

Displacement, engine. The total volume swept by the pistons of all the cylinders during one complete stroke of each piston.

Dope. The liquid material applied to the fabric surfaces of airplanes to increase their strength.

Drag. The component of the total air force on a body parallel to the wind.

Elevator. A movable airfoil, the work of which is to impress a pitching movement on the aircraft. It is usually hinged to the stabilizer.

Fin. A fixed or adjustable airfoil to afford stability; for example, tail fin, skid fin.

Fitting. This name may be used for any small part of the structure of an airplane. If without qualification, a metal part is usually understood.

Fuselage. The body of a plane to which the wings of the tail unit are attached.

Glider. An aircraft heavier than air, similar to an airplane but without a power plant.

Land plane. An airplane designed to rise from and alight on land.

Leading edge. The foremost edge of an airfoil or propeller blade.

Full load. The permissible capacity load.

Pay load. That part of the useful load from which revenue is derived, that is, passengers and freight.

Longeron. A principal longitudinal member of the framing of an airplane fuselage.

Nacelle. An enclosed shelter for personnel or for power plant.

Ornithopter. A form of aircraft heavier than air, deriving its chief support and propelling force from flapping wings.

Propeller. Any device for moving or driving a craft through water or air: a device having blades, which when mounted on a power-driven shaft produce a thrust by their action on the fluid or air.

Runway. A landing strip permitting airplanes to land and take off under all weather conditions.

Sailplane. A glider seaplane. An airplane designed to rise from and alight on the water.

Minimum flying speed. Lowest steady speed that can be maintained, with any throttle setting whatsoever, by an airplane in level flight at an altitude above the ground greater than the span of the wings.

Stability. That property of a body which causes it, when its equilibrium is disturbed, to develop forces tending to restore the original condition.

Rated engine speed. Reliable speed that has been determined for continuous performance.

Stabilizer. An airfoil whose primary function is to increase the stability of an aircraft.

Strut. A compression member of truss frame.

Super charge. To supply an engine with more air or mixture than would be inducted normally at the prevailing atmospheric pressure.

Tail. The rear part of an airplane usually consisting of stabilizing fins to which are attached certain controlling surfaces, such as elevators.

Take off. The act of beginning flight in which an airplane is accelerated from a state of post to that of normal flight.

Tank. A fixed fuel tank near each power unit into which fuel from other tanks is pumped and from which the fuel supplying the engine is drawn.

Taxi. To operate an airplane on the ground, under its own power.

Gross weight. The total weight of an airplane when fully loaded.

Warp. To change the form of a wing by twisting it. This work is now performed by ailerons.

Wind tunnel. An apparatus in which an artificial wind is produced for studying new airplane developments.

Wing. A general term applied to the airfoil, or one of the airfoils, designed to develop a major part of the lift of a heavier-than-air craft.

Projects

1. All balsa glider.
2. R.O.G. indoor model, propeller, driven by rubber band.
3. Advanced R.O.G. model, cambered wings, ribs are cut from flat sheet of balsa.
4. Elementary cabin model. To make this model requires skill and accuracy.
5. Outdoor cabin model. This model is qualified to compete in outdoor contests for prizes and it is eligible to be entered in any model aircraft contest.

In completing these five projects in the order named, the student can make steady progress from the unskilled to an advanced stage of craftsmanship. Additional models also may be purchased in kit form in almost any community. These kits are complete, including plans, materials, and the like, to make each model.

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Fine practices — eh what? Submitted by Aaron Adams, Attica, Ind.

INDUSTRIAL ARTS AND VOCATIONAL EDUCATION

John J. Metz, Editor

The A.V.A. Convention

We hear much about rationing these days. Gasoline, tires, foods, clothing, and other things we thought so necessary are, or will be shortly put on the list, probably for the duration. The public is also asked to cut down on travel for pleasure and to avoid holding unnecessary conventions.

The editor of one of the national educational journals takes this last phase as his theme in an editorial which recently appeared in his magazine. He appeals to the government to stop the American Vocational Association from holding its convention scheduled at Toledo for December 2, 3, 4, and 5. He also makes the statement: "The Federal Government finances this convention directly by paying the traveling and hotel expenses of all delegates and of local, state, and federal directors."

Evidently the writer of that editorial forgets the vital importance of the educational work done by the men who make up the membership of the American Vocational Association. It may be news to him that many of the men who attend this convention pay all of their expenses themselves. Also that the federal reimbursement for all vocational expenses in some cities is but a small percentage of the total amount expended, so that there are some local directors for whom the Federal Government contributes comparatively very little.

As far as the delegates are concerned, some of them have their expenses paid by state associations. As has already been stated, many others attend and pay all of their own expenses because they feel that they get more than their money's worth.

But suppose that the Federal Government did shoulder all of the expenses incurred by the delegates and by local, state, and federal directors, would it not be good business to gather these key-men in order that the serious business in which they are engaged, could be fully discussed and studied?

Business and industry have found it advantageous to have their sales organizations meet at least once a year to formulate sales plans and future policies. Does it not seem reasonable then, yes even imperative, that the administrative heads and others entrusted with the training of industrial workers so that war production may be stepped up, should meet to discuss common problems, and thus help each other in doing their work in a more efficient manner?

Industrial-arts teachers, who will meet at the same time, may also gain much that will help them. Many of the materials used in the school shops are no longer obtainable. Some teachers have learned how to use substitutes for the things that are off the market. Others have designed new products that are long on teaching value, but require but a small amount of material. Still others have uncovered sources of various materials which, if used in the school shops, will not interfere with the production of needed war supplies.

Should these men not get together and compare notes? Is it not a penny-wise and pound-foolish notion to look merely at the transportation and hotel costs without taking into account what is finally accomplished? Those who want to get a real slant on what vocational education means at this time may well spend the time required to read Walter J. Brooking's article entitled "Vocational Education and War-Production Training." It appears on page 371 of this issue.

Incidentally, teachers of industrial arts and vocational education should not overlook the fact that the dates for the A.V.A. convention are not far distant. If there is any likelihood of making arrangements to attend the convention, this is the time to make them.

Examples to be Followed

During the past summer months, three industrial-arts teachers and a number of students spent most of their time making a total of 2700 guns to be used by the Washington high school cadets during military training drill.

The teachers and students who made these guns, as well as those who will use them for drilling, have definitely shown a willingness to do their civic duty. They have sensed the necessity which requires the conversion of at least part of our educational efforts from a peacetime status to that of an all-out war level.

Similar commendation must be given to a Rockford, Ill., school which solved its crowded condition caused by the influx of war workers' children, by cutting the school day in half. Eight of fourteen school groups attend in the morning and the remaining groups meet in the afternoon.

Still another worth-while inauguration is the one adopted by the city of Los Angeles, Calif., where schools will grant students leave of absence to help in harvest work or to take on other necessary employment.

Examples such as these may suggest methods which well may be adopted elsewhere.

The High School Victory Corps

Originally proposed by a special committee of the U. S. Office of Education Wartime Commission, the idea underlying the High School Victory Corps has been heartily endorsed by the War Manpower Commission, by the Secretary of War, the Secretary of the Navy, and the Secretary of Commerce.

The purpose of this voluntary organization is to afford students attending secondary schools an opportunity to prepare themselves more effectively for successful participation in wartime service.

The purpose is, therefore, twofold. It offers the students an opportunity for immediate, active participation in the war efforts of their community, and at the same time, prepares them in every conceivable way, for the war service that will come after they leave school.

The work for the high school victory corps may, therefore, be offered partly as regular schoolwork, and partly as extracurricular activities. It is to be so planned that it will guide high school youth into services and occupations which may be helpful to our government, our armed forces, or some civilian cause or causes.

It is to re-emphasize to high school students what citizenship in America really means, and to give them a better understanding of the present war and all of its ramifications.

This program also aims to give students physical training so as to make as many of them as possible fit for future service in the army, and to give them better preparation in science and mathematics, the need for which has been amply shown by army tests given to the men now in our forces.

Preflight training in aeronautics for prospective aviators and ground-crew men also is to be included, as is also

preinduction training for critical occupations, and for essential service occupations of civilian life.

The committee that has proposed and worked out the preliminary outline of this wartime program is to be highly commended. Youth is anxious to participate in the present conflict, and the Victory Corps gives every high school student an opportunity to do so in such a manner that his present schoolwork will directly help him in qualifying for something definite in our efforts at bringing this war to a successful close in the shortest possible time.

The victory corps is another effort made by the school to streamline its work so that each student will be so trained that he will be best fitted for the job which he can best fill.

Should Teachers Be Deferred?

The question of whether or not teachers should receive deferment crops up again and again. Some superintendents pride themselves on the fact that they never ask for deferment for any teacher. At first sight, this seems to be a laudable, patriotic, stand to take, but it would lead one to presume that the positions made vacant by the teachers thus released from their teaching positions can be filled by others who can carry on the necessary work of educating the children who are going through schools during these troublesome times.

If such replacement is possible, these superintendents are correct in saying that they will not ask for deferment for any teacher who is called to serve in the army. However, these vacancies cannot be filled in many cases.

In an article entitled "Intensive Training to Provide Industrial-Arts Teachers During the War," by G. H. Silvius, in the October, 1942, issue of this magazine, a plan is outlined which has already been put into action for filling vacancies in the ranks of the shop teachers who have been taken out of the school. His suggestions are thoroughly worth while, but they cannot solve the entire problem.

It is true, a very serious problem confronts us. The war to safeguard our liberties must be an "all-out" war. Nothing must stand in the way of our fight for victory, for if that fight is lost we will no longer have the liberty to the rights given us by our constitution.

It must not be forgotten, however, that to achieve victory, we must possess trained workers to furnish our soldiers with the machinery of war which must be made accurately, and which makes use of the very same principles and mechanical, electrical, and chemical constituents, as those used by ingenious inventors who worked assiduously throughout the past century, not to help man kill man, but to give him an opportunity to taste of the higher things in life, to raise his standard of living, and to free him from the drudgery which might keep him from getting the most out of life.

These trained workers must now work hard at producing engines of war. It is true, only a small percentage of the total number of workers must possess a training which is so complete that they can conceive original ideas that will improve the modern weapons of war that are being used at present. There are comparatively few workers who will have to be capable of thinking out the intricacies of production methods which can increase our present war production. There also are comparatively few who must be able to do research work so that our materials of production can be improved in order that they may surpass those now in use, or be produced in greater quantities, or at less cost.

But there are large numbers of workers needed who possess certain limited kinds of skill to carry out what these men, who do possess the utmost in skill and inventiveness, find necessary for the production of their creations. Such workers have been made ready, in schools and industrial shops, by concentrated training, to operate the tools of industry in its effort to turn out more and more bombers, fighters, and transports for the air force; submarines, destroyers, cruisers, warships, airplane carriers, and other types of vessels for our merchant marine and navy; and machine guns, regulation army guns, revolvers, side arms, antiaircraft guns, many sizes of cannon for defense and offense, numerous tanks, jeeps, trucks, and other types of war machines for the army.

In the same way, workers are trained to make the many kinds of munitions needed by the men in the various branches of our fighting forces, to say nothing of the workers who must be trained for producing the everyday necessities needed by an army, which we are told, will reach a total of ten million in the comparative short space of a year.

From year to year new contingents of soldiers will be called into the armed forces as the youth of the land reaches the age of 20. These new additions also must be armed, and those arms must be produced by the production methods now in use in our industrial plants. That means that just as the army needs new recruits, a new contingent of workers must continually be trained and added to those now working in our factories.

If we lose all, or most of the shop teachers, who are now training these young workers, industry will soon be unable to train the new recruits who are to fill the ranks of the skilled and semi-skilled workers in our war-production plants. Teachers are members of a group that possess a very critical value in the total war effort. They are more important in their present position than they can possibly be anywhere else. If, for want of a nail, an important battle may be lost, we had better not get rid of those who train the nail makers.

There are two sides to this question of asking for deferments, and our administrators had better study each individual case thoroughly. The country needs its shop teachers where they can do most good — in their shops, teaching the man behind the man behind the gun. They also must do their part to live up to the challenging admonition given by the war department to its trainers: "Be d—— sure that no American soldier is killed or injured because you failed to do your part to provide adequate training."

Success Factors of Evening Classes

The principles underlying the success of evening classes are as follows:

1. Class planned to meet the needs of the worker.
2. Instructors selected who understand the worker through actual trade experience in the industry.
3. Courses of study planned to fill a present need of the worker.
4. Effective methods of giving instruction to the worker.
5. Convenient buildings and adequate equipment for the worker.
6. A helpful attitude toward the worker.
7. Recognition of faithful evening study by the worker.

— From *Organization and Instruction of Evening Classes,* Vocational Education News Letter, Pittsburg, Kans.

How to Run a High School Bowling League

R. R. BEDKER*

Bowling is a game that has stood the test of time. The Dutch brought the game to this country and played it in New Amsterdam, the town which is now New York City. The name for it then was skittles or ninepins. Later, another pin was added. From 1623 to 1840 bowling was an outdoor game. The first covered alleys were made of slate or hardened clay.

The slow development of bowling, as a game for the people, has given the promoters ample opportunity to make out of it a well-regulated sport which has a universal appeal. It is one of the few games that calls for participation for enjoyment. There are few spectators compared to football, baseball, and auto races. People want to bowl.

Another fine thing about bowling is that the ages of the participants range from seven to seventy, or over. It is an all-round game, and a most excellent winter sport. Bowling requires the use of practically every muscle in the body, yet it does not subject players to severe physical strains. With air conditioning, bowling may easily be made an all-year sport. Furthermore, it is a sport for the whole family to enjoy.

Starting a High School Bowling League

One of the first requisites in starting a bowling league is cooperation. We were very fortunate to get full cooperation from all concerned this past year.

Our high school bowling league started somewhat like this. The proprietor of the bowling alleys visited and talked over high school bowling with our principal, Mr. Ivan Swancutt. The writer was then called into the conference because the principal knew of his interest in the sport. After discussing the whole matter, the following agreement was drawn up and accepted by the proprietor of the alleys.

1. The tavern must be closed off from the alleys.
2. Reduce the bowling prices to the high school students.
3. No smoking.
4. Furnish scorebooks.
5. Furnish a pin boy for each alley.
6. Get additional bowling balls to fit boys' hands.
7. Reserve alleys for special afternoon.
8. Have one person there to help the boys.
9. No charge for school sponsoring bowling.
10. Air conditioner in operation.
11. Furnish 15 bronze bowling medals with ribbons and engraving for prizes.

The school promised to have three teacher sponsors there every week to help the boys and the alley keeper.

A formal announcement was made in the school bulletin about the bowling league. We said we only wanted 12 teams of three players and one alternate. The demand was steady so we had to increase the size of our teams twice, and finally we had a team of eight boys including three alternates. We could not take any more and the new applicants were put on the reserve list.

It is a good plan to have a few alternates on each team because of the many school activities that might keep a boy out for a week or two.

Bowling Club Officers

A high school bowling club should have officers. This is the democratic way in having pupils help run the organization. The officers usually are president, vice-president, secretary, and treasurer.

Before the election the sponsor should stress the point of electing capable boys to run the league. The officers should have the time to devote to planning and running things in general. The sponsor should try to get good officers, otherwise he will be doing all the work, instead of having the students do most of it.

The president will have charge of all general and group meetings. He should go over the plans with the sponsor before the meeting, for approval. A weekly group meeting with the captains is very important if things are to be kept running smoothly.

The vice-president should be at all meetings and take charge of every third or fourth meeting for practice. He always presides when the president is absent.

The secretary, or student manager, has the most difficult and exacting job of all the officers. He makes out the schedule with the approval of the sponsor and of the other officers. He figures all individual and team averages. He distributes and collects scorebooks from each captain, makes a weekly tabulation score sheet for all individuals and team averages, and keeps the minutes for all meetings. A good secretary will keep the club running like a well-oiled machine.

The treasurer collects all the dues of the club and makes a financial report on demand.

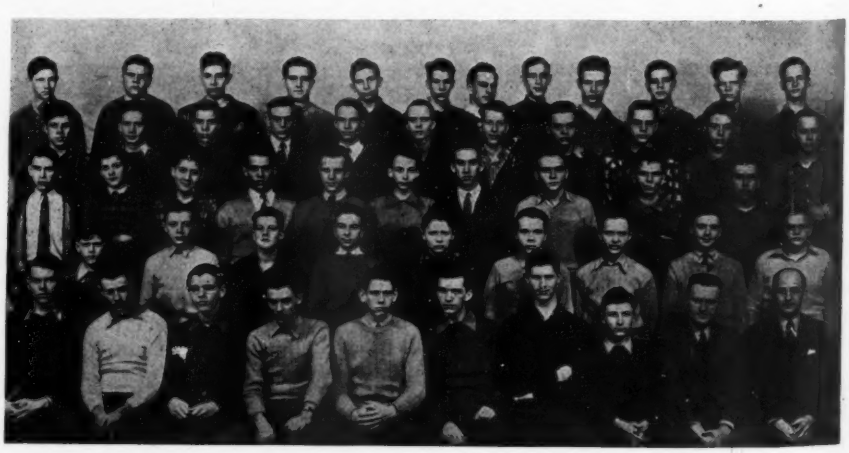
The typist makes duplicate copies of weekly score tabulations and other club notices. This past year we charged all the boys a nickel and hired the office girl to typewrite all materials outside of regular hours. The typing only cost us five dollars for the season. The ditto copies were furnished by the school.

The captains' duties are listed elsewhere in this article.

The committees should be small and dependable. Possibly a committee on prizes, tournaments, banquet, and audit would be sufficient.

The Sponsor

The sponsor of any club should, of course, be friendly toward the club. For this reason it is best if sponsors can choose their own club or clubs. It is also better if the bowling sponsor takes an *active* interest in that sport. It is not necessary for him to be an expert at bowling, because experts will be glad to help him in any reasonable manner, to make the school bowling league a real success.



The bowlers

*High School, Wauwatosa, Wis.

Objectives for High School Bowling Clubs

1. To learn how to play a worth-while game.
2. To conduct the club in a business-like way. (Officers, etc.)
3. To teach the fundamentals of bowling.
4. To get good speakers for the club.
5. To give everyone an opportunity to appear on a program.
6. To make a survey of all the bowlers in school.
7. To make a bowler's directory of the school.
8. To make a bowling club directory.
9. To give publicity to the newspaper. (School paper, annual, and local papers.)
10. To promote general interest in bowling through the bulletin boards.
11. To promote a school bowling league.
12. To promote special bowling events. (Fathers and sons, tournaments, etc.)
13. To promote fair play and good sportsmanship through bowling.
14. To keep in touch with bowling news through the *A.B.C. Bulletin*, newspapers, etc.
15. To encourage school and local libraries to get good books on bowling.
16. To promote the reading of bowling news and information.
17. To promote the reading of the A.B.C. bowling regulations.
18. To enter current bowling tournaments.
19. To enter into friendly bowling matches with neighboring schools.

NOTE: The foregoing is merely a check list of some of the activities for bowling clubs. Select only the ones you can use for your particular club. Add others of your own choice.

Rules for High School Bowling Clubs

1. All bowlers must be in *good standing in his school.*
2. Each team is allowed to carry eight boys.
3. All new members must be signed up and registered with the secretary seven days before he starts to bowl.
4. No new members may be added to any team after three fourths of the games have been played, except by two-thirds vote of the captains.
5. No prizes will be awarded to boys who have bowled in less than two thirds of the total number of games.
6. *Optional*: A handicap of two thirds the difference between the individual average of the opposing teams. The captains will figure handicaps.
7. No member is allowed to bowl on another team without the consent of the sponsor, student secretary, and captains involved.
8. In midsemester, after graduation, new members will be added to replace the senior graduates.
9. The official league afternoon will be Tuesday.
10. Starting time, 4 p.m.
11. Blind score 90 (score given to bowler when absent).
12. *Suggestion*: Low score bowlers will be out the following week and the alternates will take their places. Boys not bowling can keep score for that week.
13. The playing rules of the American Bowling Congress to govern league, excepting the rules mentioned in the foregoing.
14. *Do not copy rules.* Make your own regulations to meet the local conditions.

Captains

The captains of each team should be elected by the members of the team. A good captain will do the following things. The duties should be made known before electing the captain.

Captains will agree to the following:

1. Notify his team members who will and who will not bowl each week. Alternates can be scorekeepers.
2. See to it that five men are there from their team to bowl every Tuesday.
3. Fill out scorebooks completely and correctly each week and hand them to the secretary.
4. Know what team they are going to bowl against and on what alleys.
5. Find out if there are any graduating seniors on his team and report them to the student manager.
6. Attend the meeting of the captains every Monday.
7. Collect bowling fees and other dues from his team.
8. See that members of his team are seated when not bowling.
9. Floors and runways should be kept free from gum and candy.
10. After bowling has started all balls will be left on the racks of the respective alleys for the remainder of the afternoon.
11. Discourage money lending.
12. Create a friendly team spirit.
13. Be well versed in the rules of the game.

Team Schedule

Every team will have a number as shown below. More teams can be added.

Team Number	*Team Name*	*Captain*
1	Cubs	D. Brown
2	Panthers	S. Smith
3	Bears	J. Doe
4	Tigers	W. Quick
5	Lions	R. Jones
6	Badgers	B. Powell

The schedule will look as follows:

Date	*Alley Numbers*		
	1&2	3&4	5&6
	Team Code Numbers		
Nov. 10	1 - 2	3 - 4	5 - 6
Nov. 17	4 - 6	1 - 3	2 - 5
Nov. 24	Etc.		
Etc.			

Write to the American Bowling Congress, 2200 North Third Street, Milwaukee, Wis., for a blank form. State the number of teams in your league.

Typical Meeting

1. Call to order by president.
2. Roll call by secretary.
3. Minutes of last meeting.
4. Reports from committees.
5. Other old business.
6. New business, if any.
7. Bowling news items.
8. Discussion: *Bowling etiquette.*
9. Announcements.
10. Adjournment.

We plan to make all meetings brief, from 20 minutes to 45 minutes, depending on the importance of each meeting.

Here are some of the high lights on our program last semester.

1. Movie and talk by Elmer Baumgarten, secretary of A.B.C.
2. Bowling demonstration by Billy Sixty, bowling editor, *Milwaukee Journal.*
3. Bowling demonstration by Hank Marino, world's match champion.
4. Bowling demonstration by Eli Whitney, bowling editor, *Milwaukee News.*
5. Fathers and sons tournament.
6. Talk by Mr. Jonen, secretary of Wisconsin Bowling Association.
7. Active support by both our superintendent, Mr. Watson, and principal, Mr. Swancutt.
8. Bowling demonstration by Frank Benkowic, expert.

Try Some of the Following for Your Bowling Club

Bowling Debate. One question could be: A beginner should throw a hook or a straight ball.

Competitions. With a little planning, some novel competitions can be arranged. Faculty versus students is one type.

Using Opaque Lantern for Bowling Talks. The student speakers can use the school opaque lantern to help them give interesting talks on bowling. The pictures will show up in their natural colors. Large groups are taken care of with little difficulty.

School Bowlers Directory. Make a list of all the bowlers in your school with their addresses and telephone numbers. Duplicates can be made and given to students for reference.

Bowling News Sheet. If one or two of the bowlers is interested in writing, have them write a school bowling news sheet. The club typist can duplicate the work for student distribution. If you do not have the talent, omit the news sheet some semesters. Do not try to do everything listed here every semester. Remember: news sheets should be interesting to readers.

Bowling Magazines. The school library should subscribe to a bowling magazine.

School Annual. Mr. Niel Martin, sponsor of our annual, gave bowling a double page picture spread because of the student interest in the sport.

School and Local Papers. The *Wauwatosa News* and *Milwaukee Journal* carried weekly results of the bowling teams. Our school paper carried some bowling news in each issue.

Prizes. Special awards and prizes can be arranged by the officers of the club.

Demonstrations. Local expert bowlers will usually be glad to show boys different ways in bowling. Some of the better boy bowlers can also give demonstrations.

Bowling Fundamentals. We make it a point to cover bowling fundamentals every semester because of new members. We give every bowler an article by Billy Sixty on bowling, which in a very detailed and comprehensive way analyzes the game. The booklet is published by the *Milwaukee Journal* and will be sent gratis to persons requesting it.

How to Score Test. Give every member a copy of "How to Score the Bowling Game," published by the Brunswick Co. Pamphlet E 3526 will be furnished free in any reasonable quantities for the asking. After a few weeks or month give the bowlers a test on scoring.

Bowling Movies. Your local movie proprietor should be able to get some movie shorts on bowling.

Some local amateur movie fiend could take pictures of the boys bowling and show at a banquet or other meeting. Maybe one of the bowlers has a movie camera.

Fathers and Sons Tournament. We had a special tournament for fathers and sons. They bowled at their convenience between the hours of 4 and 7:30. A total of 66 bowled in our first tournament. We believe this is a splendid way to get fathers and sons together and be pals, both engaged in doing something enjoyable.

Bowling Banquet. To end the season with a good taste in one's mouth, it is appropriate to have a banquet. The school cafeteria will figure out a good boys' menu. We topped our meal off with a surprise number of devils food cake plus a miniature bowling pin on the cake. The bowling pin was furnished through the courtesy of the Brunswick Co.

Graphic-Arts Occupations

R. RANDOLPH KARCH*

A new connotation of the term graphic arts includes not only "those fine arts, as drawing, painting, engraving, etc., which pertain to the representation on a flat surface of natural objects,"[1] but also the processes and methods of laying ink or paint on paper or other objects, as in printing by letterpress, offset lithography, gravure, copperplate engraving, and silk screen. Most people refer to all such processes as *printing*.

Peacetime Importance of the Graphic Arts

Henry P. Porter[2] aptly expresses the full meaning of the graphic arts in these terms: "Printing is a good business. It is clean, honorable, respectable. It is celebrated as a trainer of men for higher stations in life. It has many inspiring traditions and legends. It combines the need for knowledge of everything under the sun: mathematics, mechanics, language, spelling, grammar, color, composition, salesmanship; there is indeed no limit to the accomplishments that are required of the printer. The printer is brought into contact with all other vocations and professions. No vocation or profession can really exist without the printing press. From textbooks to novels, from pamphlets to newspapers, from tickets to tax bills, no man can evade the printed word."

Graphic arts are not a concentrated industry. Almost every little hamlet in the country has its printing shop, its weekly newspaper. The large cities boast of printing plants employing thousands of workers. For years the several graphic-arts industries have ranked near the top of all industries in number of establishments, wage earners, salaried personnel, and value of products.

Recent information presented by the War Production Board through its spokesman, E. W. Palmer, Chief Industrial Consultant of the Printing and Publishing Branch, points out the importance of the graphic arts in regard to size:[3]

Number of establishments	42,000
Number of one-man establishments	15,000
Personnel of wage earners and salaried personnel	600,000
Salaries paid out annually	$953,000,000
Cost of materials purchased	$1,100,000,000
Value of end products	$3,165,000,000

In 1941, the 1857 daily newspapers of the United States achieved a total circulation of 42,080,391.[4] This was an increase of 1,500,000 over 1940. In addition to these figures, we can add the astronomical totals of the magazines and periodicals and foreign-language newspapers. Newspapers other than dailies numbered 5740 in 1935, and their combined circulation was over 19,000,000.[5]

Graphic-arts products are the handmaidens of advertising, that phenomena of American life which encourages the development of new products, justifies the investment in new enterprises, and promotes our dynamic, expanding economy.[6] The total advertising bill for 1941 has been estimated as follows: $1,920,000,000.[7] Direct mail printed material absorbed $315,000,000. Publications received the balance with the exception of $225,000,000 allotted to radio.

Census figures for 1939 showed an increase in the number of establishments devoted to publishing and printing of about 8½ per cent.

Wartime Importance of the Graphic Arts

Printing is such a common and everyday utility that we scarcely realize its value in our daily lives. Its importance is not overlooked, however, by our government and by our armed forces. Printing is a war industry.[8] The Army and the Navy are literally run on paper — paper that is printed or lithographed. For example, it takes 100 tons of paper to build one battleship.[9] This paper is printed or lithographed to provide the forms, envelopes, contracts, correspondence, and the myriad of other graphic-arts products necessary. Nautical and aeronautical maps are produced in great numbers — 2,500,000 were produced in 1941.[10] For the now famous sugar-rationing job, 700,000,000 pieces of printed matter were produced, which consumed 300 carloads of paper, and 30,000 lb. of ink.[11] Seven million Red Cross first aid books were manufactured from Pearl Harbor to April, 1942, and were then being printed at the rate of one million copies per week.[12] The Army rates printers as technicians, and employs many in its plants estimated to number from 100 to 300.[13] The reproductions department at Chanute Field alone consumed 6,000,000 sheets of paper in 1941.[14] Photographs, maps, orders, and circulars are a part of the work accomplished by printing soldiers in the ground forces and engineers.[15] Warships maintain their own printing shops, and three linotypes now lie at the bottom of Pearl Harbor in the sunken Arizona, Oklahoma, and Oglala.[16]

"The printer, like an artillery man behind his gun, is on the firing line laying down a barrage of posters, booklets, circulars, and instruction sheets aimed toward victory."[17]

*Principal, Printing High School, Cincinnati, Ohio.

[1] *Webster's New International Dictionary*, p. 942.
[2] *Elbert Hubbard's Scrap Book*, p. 92.
[3] *National Printing Education Journal*, May, 1942, p. 17.
[4] *Editor and Publisher Year Book*, Jan. 31, 1942, p. 112.
[5] INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, Mar., 1940, p. 125.
[6] *Paper Progress*, Apr., 1942, p. 30.
[7] *Printers' Ink*, Mar. 27, 1942, p. 19.
[8] *Graphic Arts Monthly*, May, 1942, p. 31.
[9] *Inland Printer*, Mar., 1942, p. 72.
[10] *Converter*, Mar., 1942, p. 28.
[11] *Advertising Age*, Feb. 23, 1942, p. 16.
[12] *Bookbinding and Book Production*, Apr., 1942, p. 38.
[13] *Inland Printer*, May, 1942, p. 31.
[14] *National Printing Education Journal*, Mar., 1942, p. 5.
[15] *American Printer*, June, 1942, p. 19.
[16] *Linotype News*, Jan.–Feb., 1942, p. 3.
[17] *Paper Progress*, July, 1942, p. 12.

On the home front, newspapers and magazines are keeping up the morale of the nation. There is no recording of the millions of printed pieces which allow the war factories to carry on the mass production of guns, tanks, ships, and the thousands of items which make up a first-class fighting force.

The interests of patriotism do not call for curtailment of printing either for defense or for the civilian consumer; actually they will be better served if printing is continued to fill all desirable needs.[18]

Career Opportunities in the Graphic Arts

The time was never more propitious for youth to enter the graphic arts than it is now. This is obvious for the following reasons:

1. There is a scarcity of trained workers, and this scarcity will increase.[19]
2. Jobs will be plentiful and wages high after the war — after one has completed his in-school training.[20]
3. Printers are in dire straits now for youth to train in their own methods and procedures of production.[21]
4. If training is started now, graduates would be ready for the revival of peacetime business.[22]
5. The trend of wages is up in the graphic arts, and they fluctuate less than in all but one comparable industry.[23]

There has been a steady decline in the number of shop-trained apprentices since 1910. In 1910 there was one apprentice to every 12 journeymen; in 1920 there was one apprentice to every 14 journeymen; and in 1930 there was one apprentice to every 20 journeymen.[24] And now, added to this lack of foresight in training youth for the graphic arts, is the effect of the Selective Service Act which is taking many young men away from the trades who are still in their apprenticeships. Many of these young men will not return: some will be killed, others will enter other occupations. In only two months after our entry into the war, 1875 men left mechanical employment in newspapers to enter the armed forces; fully 7000 left that and related employment.[25]

Opportunities abound for those who approach the graphic arts with a fresh outlook. Close adherence to 500 years of printing traditions has perhaps put printing behind many comparable industries with regard to engineering principles. That engineering standards can be applied to the graphic arts has been proved.[26] This leaves the field wide open to intelligent youth to pioneer in a field hardly touched by modern engineering principles.

Unsuitable employee material causes one of the greatest wastes in printing and lithography. Tests will be developed on experience, temperament, ability, and proficiency.[27] The youth with basic training and education will pass these tests and have the opportunity to rise in a career little dreamed of now.

Health of Graphic-Arts Workers

Printers, as a group, are fairly healthy.[28] One's long and continuous employment in the graphic arts is not incompatible with reasonably good health. Tuberculosis, which was for many years thought to be a "printers' disease," is definitely not one which workers need fear. Lead poisoning is now confined to those who do drossing of metal pots, and are therefore potentially exposed to marked inhalations of lead fumes.[29] The cleaner working conditions of today, in contrast with the shops of yesteryear, are credited with the chasing of diseases, and are credited for increasing the life span of printers from 44 to 65 years.[30]

Accidents and the Graphic-Arts Worker

When compared with other industries, printing and lithography shows a good accident record, and have one of the lowest accident severity rates.[31] The layman would probably believe that the many machines used in the graphic arts would be hard on life and limb. Such is not the case, as the greatest cause of accidents is the handling of objects, not machines.[32]

Negroes in the Graphic Arts

Generally, Negroes and whites do not usually work together in printing establishments, although a few rare cases show that pressmen work together. International union rules do not bar the Negroes, but local unions do not usually allow them to join. The Negro, however, does not have to depend upon entrance into white plants. There exist approximately 3000 all-Negro establishments, the largest of which employs 200 printers.[33] A survey shows that 107 plants give full-time employment to 1060 wage earners. The opportunity for Negro printers is now greatest in the commercial and teaching field.[34]

Women in the Graphic Arts

A printing plant could operate very well with all girl operatives,[35] and there is little in the industry that could not be performed by women. They do good work operating linotypes and monotypes, proofreading, bindery work, and presswork. They excel men in repetitive operations.[36] Girls, being about half as strong as men, should not lift objects weighing over 30 lb. if they are between the ages of 14 and 16. This is increased to 40 lb. between the ages of 16 and 18.[37] In view of the shortage of men during the war emergency, publishers are subsidizing the printing education of young women.[38] When men are called to war, about 10 per cent are replaced by women.[39]

The School's Place in Apprentice Education

With the breakdown of the apprenticeship system of training youth for the graphic arts as pointed out earlier in this article, the vocational high schools are training more and more young men and women for entrance into the trades. Now, printers look forward more and more to the vocational classes for fresh talent.[40] It is the opinion of the graphic-arts press that the labor shortage will be with printers for some time unless they fill the schools with students.[41] Printers, being specialists in production, and not in trade training, do, in most large cities, look to the schools for apprentices. The accounting of all time by all working journeymen militates against the explaining of processes and methods to young learners.[42]

Graphic-Arts Occupations

The "all-round printer" of yesterday is gone, save in one man establishments, and even there much of the work is "farmed out" to other specialists. Specialization is now the keynote in the industry.[43]

A thorough study into the fields of the graphic arts will reveal as many as 65 separate occupations. In the largest plants, each occupation consumes the time of one or more men; in smaller establishments, it may be that two or more of the occupations will be handled by one workman.

For the sake of discussion, these occupations are broken down into four categories: *immediate positions*, into which a young man may enter upon his graduation from school; *intermediate positions*, which are usually his goal upon entering the work; *executive and professional positions*, to which he can aspire, and *allied positions*, to which he may want to transfer after he has mastered the basic training and experience necessary.

Immediate Positions

1. Ad compositor
2. Bindery worker
3. Copyholder
4. Cutter
5. Cylinder pressman's helper
6. Junior salesman
7. Layout helper
8. Machinist's helper
9. Ludlow operator
10. Material maker operator
11. Offset platemaker's helper
12. Offset pressman's helper
13. Pamphlet binder
14. Platen pressman
15. Pressfeeder
16. Property man
17. Rotary pressman's helper
18. Stereotyper

[18] *Printing News*, Apr. 11, 1942, p. 3.
[19] *National Printing Education Journal*, May, 1942, p. 3.
[20] *Ibid.*
[21] *New England Printer*, Mar., 1942, p. 9.
[22] *Inland Printer*, Feb., 1942, p. 28.
[23] *Facts About the Printing Industry for Schools*, p. 14.
[24] *Facts About the Printing Industry for Schools*, p. 3.
[25] *Editor and Publisher*, Mar. 7, 1942, p. 3.
[26] *Printing*, Oct., 1941, p. 38.
[27] *American Printer*, Dec., 1941, p. 16.
[28] INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, Dec., 1935, p. 361.
[29] *Inland Printer*, Mar., 1941, p. 30.
[30] *Editor and Publisher*, Sept. 13, 1941, p. 35.
[31] INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, Nov., 1935, p. 335.
[32] *American Printer*, Aug., 1941, p. 28.
[33] *National Printing Education Journal*, May, 1942, p. 18.
[34] *Ibid.*
[35] *Printing*, Mar., 1942, p. 35.
[36] *Inland Printer*, Apr., 1942, p. 44.
[37] U. S. Public Health Service recommendations.
[38] *Editor and Publisher*, Apr. 25, 1942, p. 26.
[39] *Editor and Publisher*, Mar. 7, 1942, p. 3.
[40] *National Printing Education Journal*, May, 1942, p. 3.
[41] *Inland Printer*, Oct., 1941, p. 57.
[42] *National Printing Education Journal*, Mar., 1942, p. 15.
[43] INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, Oct., 1937, p. 320.

Intermediate Positions

19. Bookbinder
20. Camera operator
21. Cylinder pressman
22. Estimator
23. Hand compositor
24. Layout man; typographer
25. Layout man in lithography
26. Offset platemaker
27. Linotype machinist
28. Linotype operator
29. Lithographic pressman
30. Make-up man
31. Monotype caster operator
32. Monotype keyboard operator
33. Proofreader
34. Rotary pressman
35. Stone or imposition man
36. Teletypsetter operator

Executive and Professional Positions

37. Bindery foreman
38. Composing room foreman
39. Layout counselor
40. Platemaking foreman
41. Owner-operator
42. Pressman foreman
43. Printing engineer
44. Printing-lithography salesman
45. Production superintendent
46. Typographer

Allied Positions

47. Artist-designer
48. Business manager
49. Equipment salesman
50. Electrotyper
51. Executive superintendent
52. Graphic-arts teacher
53. Gravure platemaker
54. Gravure pressman
55. Office manager
56. Photoengraver
57. Photographer
58. Printing-journal writer
59. Reporter-editor
60. Rubber platemaker
61. Supply salesman
62. Type founder
63. Silk-screen printer
64. Copperplate printer
65. Inkmaker

An examination of the foregoing list of graphic-arts occupations is revealing in that the artistic, the mechanical, the mathematical, the social, the strong, and the not-so-strong, the aggressive and the retiring — all types of people with all kinds of interests and abilities — can probably find work which satisfies them.

Within this list are jobs which are clean, others dirty; some are repetitive, others diversified; some will suit the loquacious, others the taciturn. Still others will appeal to those who delight in competitive situations, while there are also jobs suited to those who have cooperative natures. There are jobs for white-collar workers, and for those who prefer blue shirts; also for the workers who are cogitative, as well as for those who prefer automatic operations.

Following the outline suggested by Myers,[44] the following paragraphs will endeavor to explain each one of the occupations listed with respect to the nature of the work, working conditions, personal qualities needed, preparation needed, opportunities for advancement, compensation and advantages and disadvantages. Because the importance of the occupation has been pointed out earlier in this article, no mention will be made any further.

Immediate Positions

1. Ad Compositor

Nature of the work — The ad compositor assembles the types and materials used in composing advertisements found in newspapers and periodicals. He may or may not set type by hand, especially in the large newspaper ad rooms. Most of the ads are already laid out, i.e., planned, and he merely follows this layout.

Working conditions — Usually good, in well-lighted, often air-conditioned rooms. Most newspapers are organized, and have a strong union, making for better working conditions.

Personal Qualities Needed — The ability to take orders willingly, to work well with others on group projects, and the ability to read and follow written directions.

Preparation needed — school or shop apprentice training.

Opportunities for advancement — Ad layout man, who designs and marks each line for type composition, and ad-room foreman.

Compensation — $1.325 per hour for a 37.8 hour week on the average. Cincinnati scale is $1.36 per hour for a 37½ hour week. Night work scale national average is $1.405 per hour for 37.8 hours; Cincinnati, $1.45 per hour.

Advantages and disadvantages — work is inside, one must stand at work, apprenticeship is six years.

2. Bindery Worker

Nature of the work — After jobs are printed, they usually must be folded, trimmed, bound, punched, perforated. The bindery worker performs the finishing operations.

Working conditions — Depend largely on the size and type of plant. Usually light, easy work.

Personal qualities needed — The worker must be able to gain satisfaction from performing the same task over and over, for hours, perhaps weeks, on end.

Preparation needed — Apprenticeship of a few years, or comparable school training.

Opportunities for advancement — Promotion to foreman or forelady of the bindery.

Compensation — Minimum of from 30 cents to 40 cents per hour; maximum of 80 cents to $1 per hour.

Advantages and disadvantages — Repetitious work while either sitting or standing.

3. Copyholder

Nature of the work — The copyholder reads the original copy to the proofreader, so that the latter can mark any corrections made in typesetting. Filing and delivery of proofs are other duties.

Working conditions — Usually good, but in some cases noisy and the equipment may be very poor.

Personal qualities needed — The worker must have the ability to read well and quickly, and to pay strict attention to details. He must be able to read all day from manuscript, and aloud to the proofreader.

Preparation needed — Very little mechanical preparation is needed, although a thorough knowledge of printing will hasten promotion. A well-rounded, general education is a requirement.

Opportunities for advancement — Promotion to the proof desk as reader.

Compensation — Varies depending upon the type of plant; often a 40 cents per hour minimum, probably 80 cents per hour maximum.

Advantages and disadvantages — One must read all day, which may be tiring to the eyes. One must sit at a desk most of the time.

4. Cutter

Nature of the work — The cutter works in printing shops of the commercial type, and in lithographic plants. His duties are to receive the paper stock in large sheets, and on order cut them down to the sizes needed to print the jobs. After printing, the jobs must be trimmed.

Working conditions — The cutter usually works alone, on a large power-driven cutting machine. He must lift heavy piles of paper, and cut them accurately.

Personal qualities needed — Reasonable strength — as great as that required by a cylinder pressman. The ability to check other's figures for errors in computations.

Preparation needed — A bindery apprenticeship, or its equivalent in a school.

Opportunities for advancement — Promotion to bindery foreman.

Compensation — 80 cents to $1 per hour.

Advantages and disadvantages — Often tiring work involved in the lifting of paper stock. One must stand at work all of the time.

5. Cylinder Pressman's Helper

(See Cylinder Pressman.)

6. Junior Salesman

(See Printing and Lithographing Salesman.)

7. Layout Helper

(See Layout Man or Typographer.)

8. Linotype Machinists' Helper

(See Linotype Machinist.)

9. Ludlow Operator

(See Hand Compositor.)

10. Material Maker Operator

Nature of the work — The material maker operator runs a machine which manufactures the spacing material used in printing composing rooms.

Working conditions — The machines are hot, as they use molten type metal at a temperature of over 400 deg. F. One or more machines are operated at one time, and the material must be placed in its respective bins after it is cast.

Personal qualities needed — The ability to stand all day and watch to see that the machines are in good working order, and that the product is up to standard.

Preparation needed — Very little; training is usually given in the shop.

Opportunities for advancement — A graduation to other departments: as linotype machinist helper, to the monotype caster room, or to the hand composition department.

Compensation — from 40 cents to 75 cents per hour.

Advantages and disadvantages — Hot and repetitious work, with most of one's time spent either standing or sitting, watching the machines.

11. Offset Platemaker's Helper

(See Offset Platemaker.)

12. Offset Pressmen's Helper

(See Lithographic Pressman.)

[44] Myers, George E., *Principles and Techniques of Vocational Guidance*, p. 121.

13. PAMPHLET BINDER

(See Bindery Worker.)

14. PLATEN PRESSMAN

Nature of the work — The platen press is one of the most simple to operate. It is either hand-fed by the pressfeeder, or has an attachment which feeds each sheet into the press to receive the impression of the type. It is the duty of the platen pressman to prepare the machine to print each individual job, with the assistance of the pressfeeder.

Working conditions — Light lifting is required, otherwise the work is not hard.

Personal qualities needed — One must work well with others, although usually the responsibility of turning out a good job rests with the platen pressman.

Preparation needed — A platen press apprenticeship, or its school equivalent.

Opportunities for advancement — Promotion to cylinder presswork; pressman-in-charge of the platens, or pressroom foreman.

Compensation — 80 cents to $1 per hour.

Advantages and disadvantages — Inside work, often requiring the job of washing the ink from presses and press rollers.

15. PRESSFEEDER

(See Platen Pressman.)

16. PROPERTY MAN

Nature of the work — The property man's duties vary greatly, depending upon the type of plant. In some cases he merely sees that material bins are kept full in the composing rooms. In other cases he expedites work by taking care of the filing of engravings used for illustrations, and renders aid in many ways to the composing-room foreman.

Working conditions — Usually good. Similar to those of the hand compositor.

Personal qualities needed — The ability to seek out work without direct supervision, and facilitate the work of others.

Preparation needed — Usually a composing-room apprenticeship.

Opportunities for advancement — To hand compositor.

Compensation — 50 cents to $1 per hour.

Advantages and disadvantages — Often merely a job of cleaning up and placing items in their places; repetitive operations.

17. ROTARY PRESSMEN'S HELPER

(See Rotary Pressman.)

18. STEREOTYPER

Nature of the work — Stereotyping is a duplicate platemaking process. Illustrations and type matter, as well as entire pages of newspapers, are often duplicated so that many can be printed at one time, or to make them in cylindrical form so that they can be used on rotary presses.

Working conditions — Usually good in newspaper shops and in typographical service plants where advertisements are composed and duplicated for advertisers and advertising agencies.

Personal qualities needed — Must have the ability to work near hot metal pots, and to perform duties either alone or with others.

Preparation needed — An apprenticeship in a stereotype room.

Opportunities for advancement — Promotion to stereotype foreman.

Compensation — Average wage for the country is $1.201 per hour or $1.264 in Cincinnati. Work week averages 38.8 hours.

Advantages and disadvantages — Hot work, with some little danger of being burned by molten metal.

Intermediate Positions

19. BOOKBINDER

Nature of the work — The making of bound books from printed sheets of paper delivered to the bindery in large sheets, with as many as 64 pages printed on each side of the paper. The sheets must be folded, sewn together, cased with covers, stamped in gold as to title and author, and other duties.

Working conditions — In a large plant, only several operations may be performed by the binder; in smaller shops, he may indeed be the only binder in the shop, and perforce must do all operations.

(To be continued)

Problems and Projects

BENCH BLOCK

WILLIAM A. DE VETTE

Technical High School
Erie Pa.

(*For the illustration see page 393*)

The bench block is used as a project in the early stages of a machine-shop student's training, and offers a number of elementary operations without the necessity of scrapping the entire project should the student make a mistake at any one point. There is nothing about the project which must be held to close limits and the instructor may use his own judgment in holding the students to any limits he may desire.

The completed project has many uses in the shop and if a number of them are already available they may be turned over to the students for their personal use at home or at the job they expect to have at some future time.

A SIMPLE ELECTRIC SOLDERING COPPER

J. L. SOLOMON

Calumet High School
Chicago, Ill.

The national emergency has affected each one of us in the teaching profession. Shop teachers, especially, will feel the effects of this in a number of ways. Due to the priority rights of those engaged in producing war materials and equipment, the things needed to operate a school shop are increasingly more difficult to obtain. The instructor will find that it will be necessary for him to operate his shop with less and less metal.

The writer, for instance, found that he could not obtain certain materials for the manufacture of a soldering iron — one of the projects he had been using in his classes in electricity. This soldering iron had been made of the following materials:

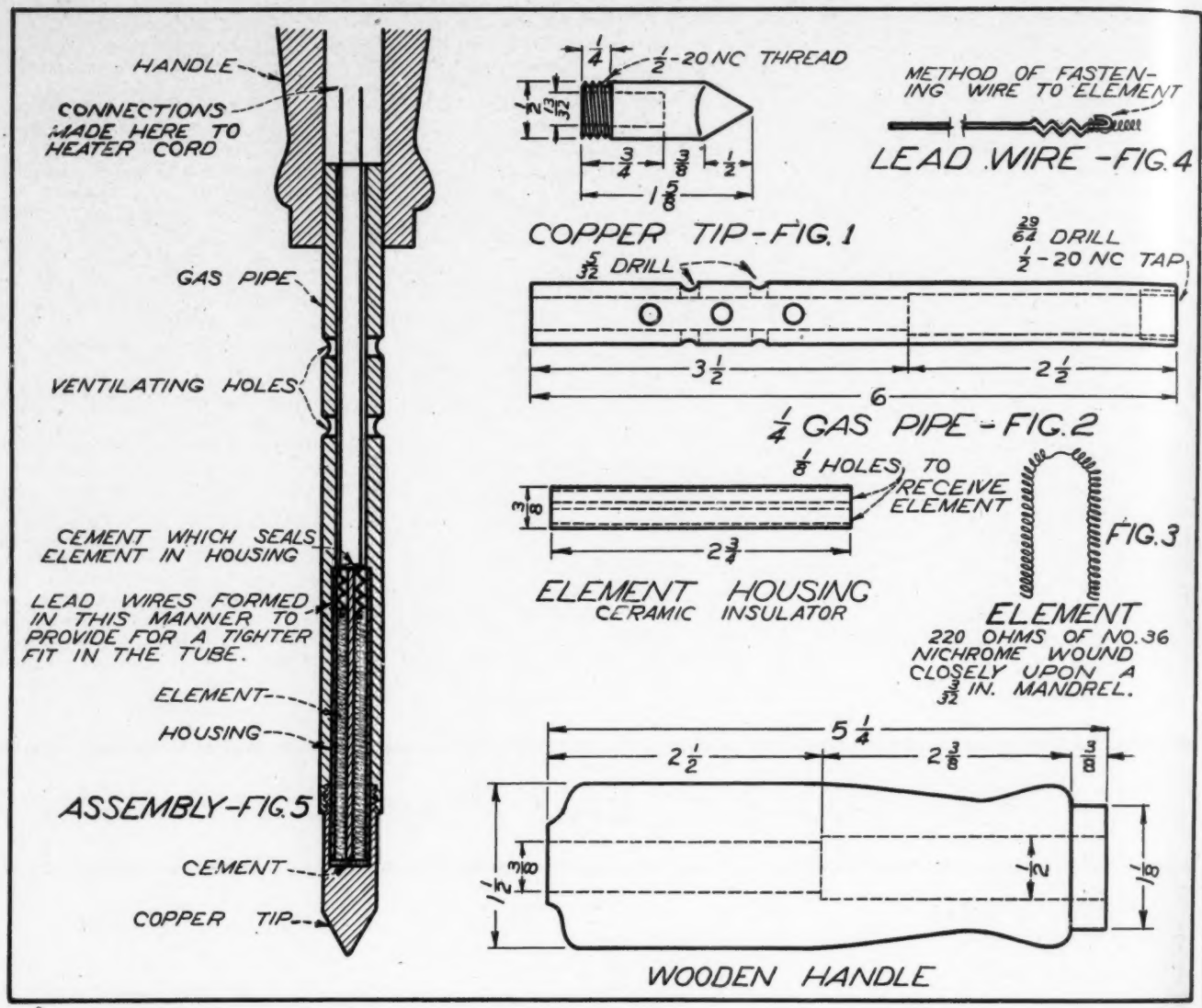
Amount required	*Material*	*Size*
1	Copper rod	½ in. dia. x 5 1/5 in. long
1	Brass	1 in. dia. x 3½ x .035 wall
25 ft.	Nichrome wire	No. 30
1	Length of brass tubing	1 in. dia. x 3½ x .035 wall
1	Length gas pipe	5 x ⅜ in.
6	Brass machine screws	¼ in. x 8/32
	Asbestos sleeving	12 in.
	Asbestos heating cord	6 ft.
1	Plug	
1	Sheet asbestos paper	2¾ x 12 in.
1 oz.	Sauereisen cement	
1	Wooden handle	

Because some of these materials could no longer be obtained, the soldering iron described herein was developed. This new type of soldering iron utilizes very little raw material, draws less current from the lines, is much more efficient, smaller in size, weighs less, and is a better iron in every respect. All the parts needed for its construction are as follows:

One 1⅝-in. length of ½-in. copper rod
One ¼-in. gas pipe, 6 in. long
1 ceramic insulator
8 ft. No. 36 nichrome wire
1 ft. asbestos lead wire
6 ft. asbestos heater cord
1 plug
1 wooden handle

In making this iron, the student will perform quite a number of operations such as drilling, tapping, threading, and the like.

The tip is shown in Figure 1. Cut a ½ by 20 N.C. thread on the end of the copper rod for a distance of ¼ in. Set the stock in the lathe and drill one 13/32-in. hole ¾ in. deep. Cut off the stock and file point to shape shown. The gas pipe is drilled at one end with a 29/64-in. drill, to a depth of 2½ in., as shown in Figure 2. It is then threaded for a distance of ¾ in., with a ½-in. by 20 tap. Ventilating holes are then drilled in the gas pipe as shown in Figure 2. The element is made by taking an 8-in. length of No. 36 nichrome wire and winding it in the form of a closely wound spring, using a 3/32-in. steel rod as a mandrel. It is most important to see that the wire is wound uniformly and as close



Soldering iron

together as possible, one turn touching the next. This should make a springlike element approximately 2½ in. in length with an outside diameter of approximately ⅛ in. This is shown in Figure 3. Some of the asbestos is then removed from the nickel lead wires, pulled through the space between the third and fourth turn, and then bent over and crimped onto the first three turns at each end of the element. The lead wires are then bent as illustrated in Figure 4. The two leads are then inserted into the holes in the ceramic insulator tube and are then slowly pulled through the tube, the wire being divided in the center first and then pulled slowly so as to leave a single wire stretching from one hole in the tube to the other hole. The lead wires are pulled until the bent portion reaches the bottom of the tube. This bent portion prevents the lead wires from being pulled out of the tube easily. A small quantity of quick-setting cement is used to cover both ends of the tube. It is well to see that a small quantity of this cement is inserted into each hole, thus sealing the element in the ceramic tube. The element can then be tested for resistance. It should have a cold resistance of 220 ohms. If this tests O.K. the element can be placed across the 120-volt line for the heating checkup. The ceramic tube should give off a faint red glow. The ceramic tube used in this iron has a very high tensile and compressional strength and is not in the least brittle. It may be thrown against another ceramic tube and may be handled very carelessly without any damage whatsoever. In fact, the writer threw a number of them against some metal pipes with great force without breaking them. The element may then be inserted into the threaded end of the gas pipe. One half inch of the element will protrude from the gas pipe. The shoulder on the inside of the gas pipe will keep the element from slipping out of it. The asbestos heater cord is put through the handle, knotted and tied, and the connections are made from the lead wires to the heater cord. The end of the gas pipe is then forced into the wood handle for a distance of ¾ in. The tip is then placed over the element and screwed into the gas pipe. One half inch of the element extends into the copper tip. This makes for fast heating and more efficient operation. The iron is now completed and ready for use. It appears as in Figure No. 5. It may be rated at 55 watts, 120 volts, a.c./d.c. This iron is small enough to be used for radio work and all small soldering jobs. It provides enough heat to do a good job on 20-gauge iron.

This shows what can be done in the way of utilizing the materials which are easily obtainable and which we have on hand in order to assist in the present emergency.

The materials used may be obtained from the following:

Copper rod:
A. M. Castle & Co., 1132 Blackhawk St. Chicago. Ill.
Ryerson Steel Co., 16th & Rockwell Sts., Chicago, Ill.
¼-in. gas pipe:
From any hardware store.
Resistance wire, heater cord, and asbestos covered lead wire:
Wilbur B. Driver Co., Newark, N. J.
Driver-Harris Co., Harrison, N. J.
Ceramic insulators and cement:
Electronic Control Co., 7956 South Phillips Ave., Chicago, Ill.

USEFUL TOOL PANELS

ELMER E. CLAUSEN

Formerly at Waukegan Township High School
Waukegan, Ill.

Instructor, U. S. Army Air Corps Technical School
Rantoul, Ill.

In a school print shop where the tools for maintenance were kept here, there, and everywhere, the tool panels shown in Figures 1 and 2 were made. They solved the problem quite well. Instead of outlining and painting

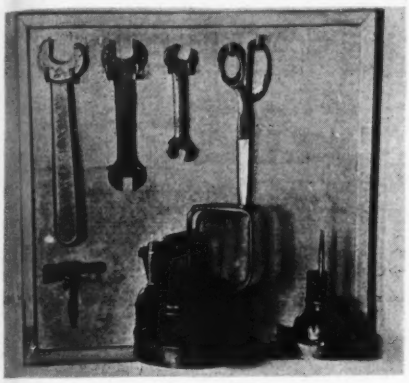


Fig. 1. Tool panel

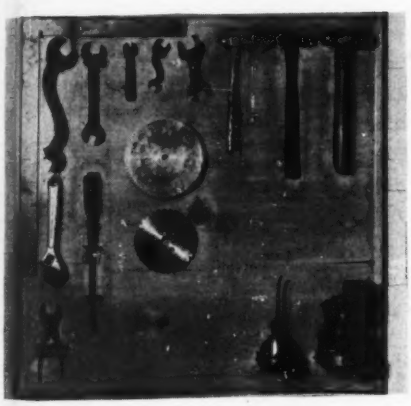


Fig. 2. Tool panel

all the backgrounds on the board, the tool silhouettes of heavy, stiff, black paper were cut out. With the panel flat on a table the tools were located for placement and marked for the hooks. The panel was then placed in its proper place on the wall, and with nails in place of the hooks, the tools were checked to be sure they would hang straight. The hooks were then placed, after which the black paper cutouts were mounted. This was done by painting a coat of a good grade of clear shellac on the board and on the back of the silhouettes. After pressing the cutouts in place, they were allowed to dry, after which a couple of coats of shellac were given to the top of the paper. These cutouts were found to be quite serviceable, and an occasional coat of shellac will keep them in the best of condition and perfect in appearance.

The advantages of these paper cutout backgrounds are (1) more accurate outlines, (2) timesaving in preparation, and (3) ease of replacement or renewal.

TYPEWRITER DESK

JAMES McGREGOR

Polytechnic Elementary and Junior High School
Pasadena, Calif.

The typewriter desk described herewith is very simple and compact. It also may be used as a work desk in a boy's room. It embodies a variety of woodworking problems, and yet may be made by the average ninth-grade boy, at a very reasonable cost. With the exception of the top and typewriter leaf, the material used is white pine, ponderosa pine, or other inexpensive material available according to location.

Quality workmanship need not suffer on account of low-cost materials, however, and well-made dowel, dado, and drawer joints can still be achieved.

The swinging typewriter leaf disappearing into the desk, not only adds to comfort and convenience, but protects the typewriter from dust when not in use. For those who do not desire a typewriter desk, two drawers may be substituted in place of the cabinet front door.

There will be those who will argue for better material, such as walnut or mahogany. More important than turning out a highly polished, expensive-looking desk is to afford the student as many opportunities for learning as possible. In these times we should know that to use hard or imported wood is to place an overstrain on our shipping facilities, or to deplete supplies in stock.

While this desk is a departure from the conventional, its construction is solid and sound. The deep drawer at the bottom is useful for keeping records in an orderly, accessible fashion.

Sides, top and back frames, and drawer frames are made first. If the sides are glued up now to make material 23⅛ in. wide, the glue can be setting while work proceeds on top and back frames. These may be joined by dowel or dado joints. The top one is not solid all the way over as might be expected for a desk top. There is only the 21¼-in. solid piece at the right, and a 3-in. rail at the left.

The reason for this is to allow a good fastening of middle side to the top, by screwing through the side into the top, rather than through the top into the side on the end grain.

If an open kneehole in the back frame is not desired, a sheet of ⅜-in. plywood may be used to take the place of the back frame. This frame, however, is rigid construction, and that is what is needed for a typewriter desk to be satisfactory.

The sides can now be cleaned up, ends squared, and notches formed on the top ends. These notches are to receive the top frame. On the two sides forming the left-hand side of the desk there are also two notches at the bottom edges. These are for receiving the baseboard. Cleats could be used to slide the drawers on instead of frames shown in the drawing. This cuts down time, but is not so rigid as the frame type.

The three drawer frames of ¾-in. material can be dadoed or doweled at the corners. If dado joints are to be used throughout all frames of top, back, and drawers, these joints can be done at one operation or setting of the saw. Likewise the gluing can be taken in as one unit of work.

After cleaning off all the drawer frames you are now ready for assembly.

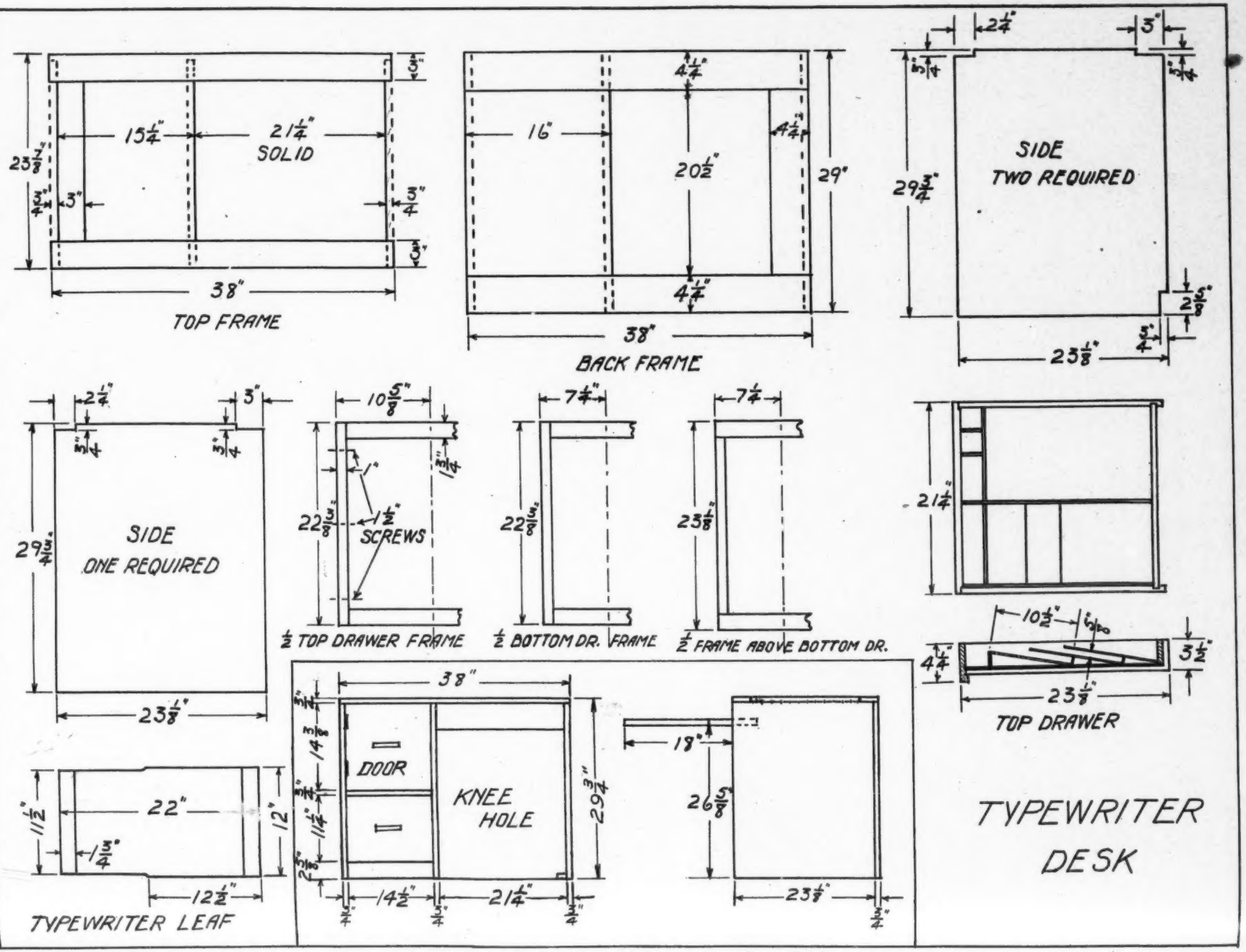
Top and bottom drawer frames are fastened to the sides of the desk with 1½-in. screws. This is easier done before the top or back are fastened. The back frame now slides into place. This is also screwed to the edges of the

(Continued on page 395)

Bill of Material

No. required	*Name*	*Size*
2	Top frame	¾ x 3 x 38
1	Top frame	¾ x 3 x 17⅞
1	Top frame	¾ x 21¼ x 17⅞
1	Top	⅛ x 23⅞ x 38-in. tempered prestwood
2	Back frame	¾ x 4¼ x 38
1	Back frame	¾ x 4¼ x 20½
1	Back frame	¾ x 16 x 20½
3	Sides	¾ x 23⅛ x 29¾
2	Top drawer frame	¾ x 1 x 22⅜
2	Top drawer frame	¾ x 1¾ x 20¼
2	Bottom drawer frame	¾ x 1 x 22⅜
2	Bottom drawer frame	¾ x 1¾ x 13½
2	Frame above bottom drawer	¾ x 1 x 20⅝
2	Frame above bottom drawer	¾ x 1¾ x 14½
1	Baseboard	¾ x 2⅝ x 16
1	Shelf	¼ x 14½ x 22⅜
1	Bottom drawer	¾ x 11¼ x 14½
2	Bottom drawer	½ x 11¼ x 22⅞
1	Bottom drawer	½ x 10½ x 13⅞
1	Bottom drawer	¼ x 13⅞ x 22⅝
1	Top drawer	¾ x 4¼ x 21¼
2	Top drawer	½ x 3½ x 22⅞
1	Top drawer	½ x 2⅞ x 20⅝
1	Top drawer	¼ x 20⅝ x 22⅝
2	Divisions in top drawer	5/16 x 2⅞ x 21⅞
1	Divisions in top drawer	5/16 x 1¾ x 9¼
1	Divisions in top drawer	5/16 x 2¾ x 17
1	Divisions in top drawer	¾ x 2½ x 12
3	Divisions in top drawer	¼ x 9¼ x 10½
3	Divisions in top drawer	¼ x ⅝ x 10½
1	Door	¾ x 14⅜ x 12
2	Door	¾ x 1¾ x 14⅜
3	Door stops	¼ x ¾ x 15
1	Typewriter leaf	⅞ x 12 x 18½ birch or maple
2	Typewriter leaf	⅞ x 1¾ x 12 birch or maple

1 pair 2-in. narrow brass butts
1 small ball door catch
2 brown plastic drawer pulls 3¾ in.
1 portable typewriter fixture

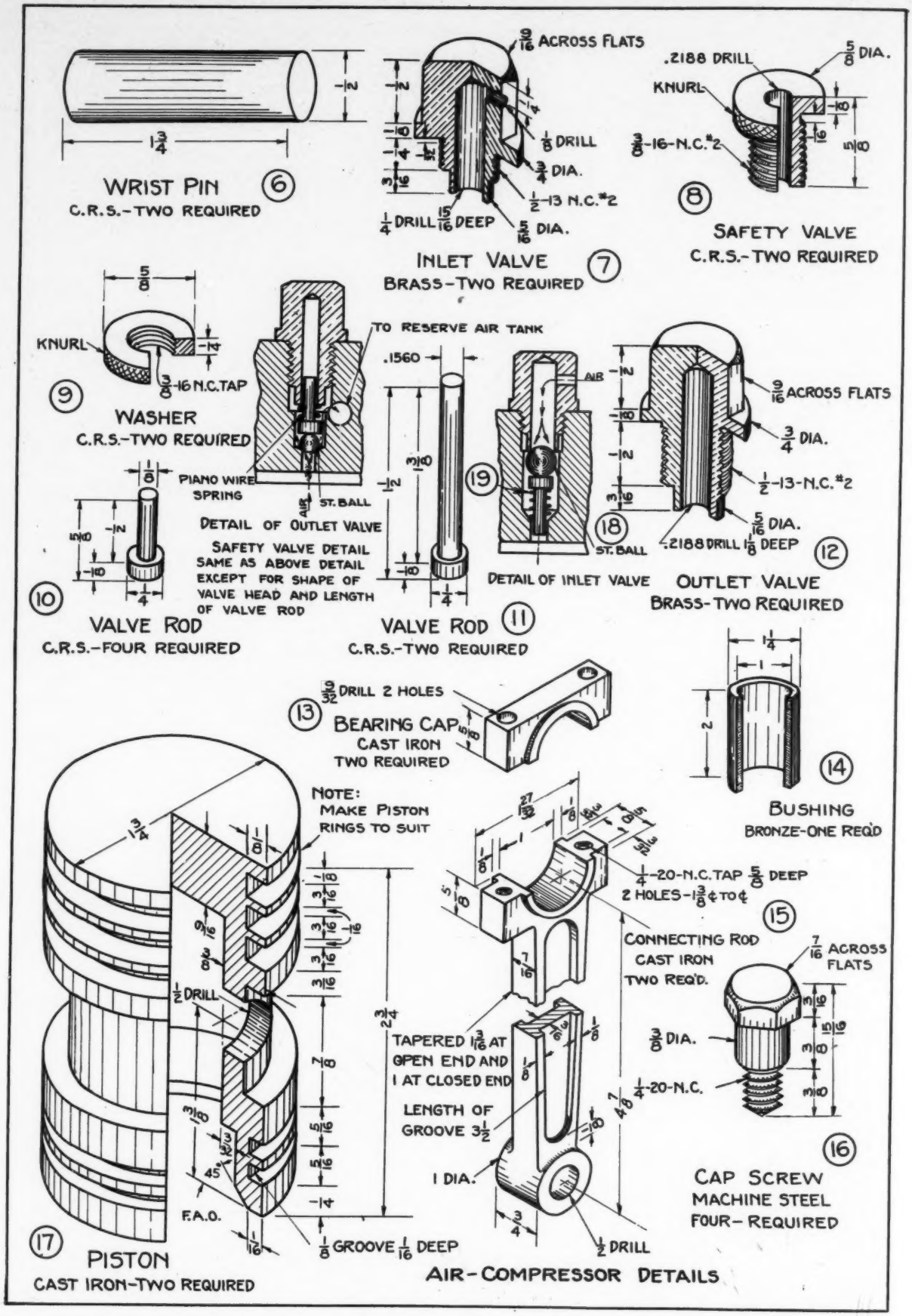


Typewriter desk by James McGregor, Pasadena, Calif.

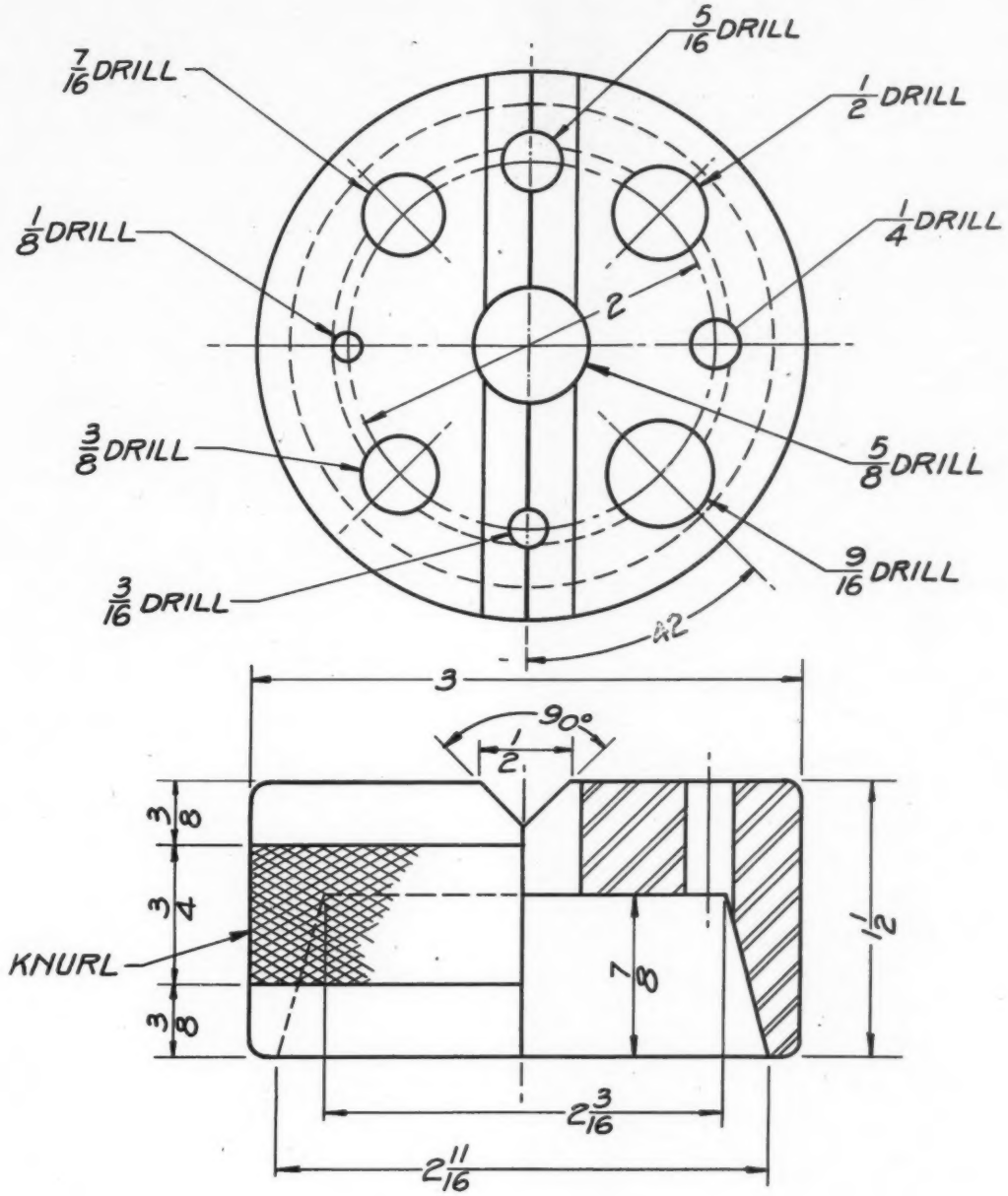
TYPEWRITER LEAF	24	24	24	54	

Typewriter desk by James McGregor, Pasadena, Calif.

1942



Air-compressor details by Frank E. Anthony, Technical High School, Erie, Pa. For description, assembly, and other details, see pages 331, 348, and 349 of the October, 1942, issue



MATERIAL: MACH. STEEL
CASE HARDEN

BENCH BLOCK	DWG. NO.

Bench-block details by William A. DeVette, Instructor, Technical High School, Erie, Pa.
(For description see page 387)

(Continued from page 389)

sides of the desk from the back. The top frame is easily slipped into place and screwed down.

On the outside of the ends the screws are sunk in deep enough to allow a wood plug to be glued in to fill up the hole and leave a smooth surface.

The frame for sliding the top drawer is now screwed in place. If center drawer guides are desired, these are easier to insert now. A shelf of ¼-in. plywood covers the frame above the bottom drawer.

The door for the typewriter compartment is of ¾-in. material, with cross ends on each side to prevent warping.

Making the drawers to fit just snugly enough to keep them from being sloppy, and just loose enough to make them slide with the greatest of ease, is a tricky job. Time may be cut by making the total width of the drawers ⅛ in. narrower at the back than at the front. With center guides, the time of fitting will be lessened.

The top drawer has been divided into compartments for paper and other desk supplies. Although this is not essential, it does add to the efficiency of the person using the desk, and also to the economy of materials by having designated places for storage.

The installation of the typewriter leaf should not present much difficulty. The portable typewriter fixture may be purchased from a firm dealing in hard-to-get materials. It is a simple fixture easy to install. There is only one point where caution is necessary. The typewriter table must be installed in a truly level position. When doing this it is well to see that the desk is level (desk top frame) before beginning. If the typewriter is out of level in any way, there is the danger of damage to the machine itself when it is used in the off position. Two ¼-in. stove bolts anchored in place on the leaf to suit the holes in the bottom of the typing machine, will hold the machine and keep it from traveling by vibration. These bolts should project 1 in. above the surface of the leaf.

A cleat fastened on the bottom edge of the right-hand side of the desk will keep the wide material from warping.

The finished top material of ⅛-in. prestwood is very satisfactory material to write and draw on. All that has to be done with this is to glue and clamp well in place in preference to nailing.

With a light ivory enamel finish, brown plastic handles, and a brown prestwood top, there is a pleasant contrast of simple colors, which will fit into almost any type of surroundings.

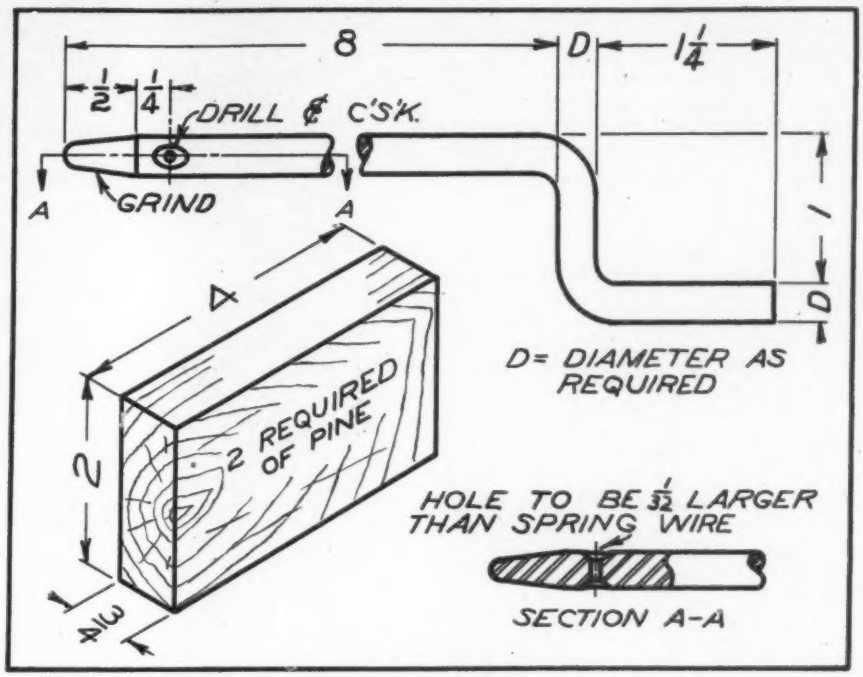
SPRING COIL FORMER

ARTHUR L. BAGSHAW
Central Jr. High School
Victoria, B.C., Can.

The simple device shown here is for making tension or compression coil springs of almost any diameter and length.

To make a coil, all one needs is a rod of mild steel 10 to 12 in. long and of a diameter suitable for the spring, and two soft white pine blocks. Make sure that all sharp edges have been removed from the hole in the steel rod. The hole should be drilled 1/32 in. larger than the diameter of the wire to be used.

To form a coil place the rod between the two blocks of wood and place assembly in a vise. Don't have vise pressure too tight at the start. After a couple of turns, tighten up on the vise. Insert the wire in the hole in the rod and turn to make coil. The angle at which the wire is fed will determine the spacing between the turns of the coil.



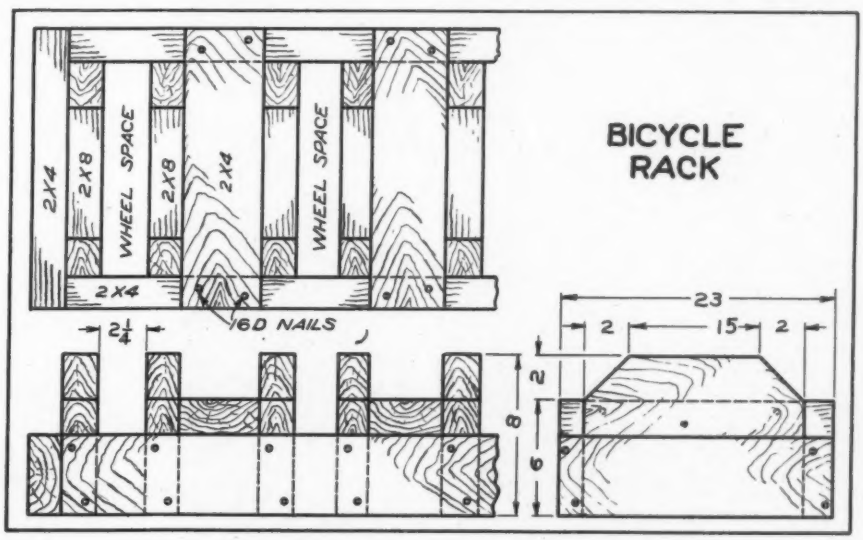
Coil spring former

A HANDY BICYCLE RACK

J. R. HANKISON
Junior High School
Logan, Ohio

The bicycle rack described here has been found satisfactory in every way.

The bicycles may be parked from either side and with either the front or rear wheel in the rack. Stock size lumber was used in the construction of the rack and only the dimension for the wheel space is given as the rack may be made to hold as many bicycles as may be necessary. We constructed them in sections to hold 12 bicycles. This makes the rack easier to move.



MAKING HOME MECHANICS EFFECTIVE

George W. Deffendahl*

In order to make our home-mechanics course as practical as possible the following plan was devised.

At the beginning of the course each boy is given a copy of the following letter:

DEAR PARENTS:

The purpose of industrial arts in our elementary schools is to give the boys an opportunity to explore several different kinds of work. We are trying to improve the desirable activities that are important in life; such as, the practical life problems of the home and the community.

*Baker School, Evansville, Ind.

We aim to correlate the facts and principles which the boy learns in industrial arts with real life activities.

In order to accomplish this we must furnish the boy with real experiences from life. We are offering a course in home mechanics which we feel gives the boy a splendid opportunity to develop his initiative and to develop tendencies to explore further in similar fields.

There are several jobs that a boy can do in the home that cannot be brought to school. In order to promote work in practical experiences we urge the cooperation of the parents in carrying on this activity.

This includes such jobs as refinishing and repairing furniture, electrical appliances, plumbing, and the like.

Kindly check the card which is enclosed, to give us your estimate of work done at home by your boy.

Sincerely yours,
George W. Deffendahl

After a job has been decided upon, the boy and the instructor discuss the best methods and materials to be used. When the job is completed the boy is then given a card, like the one printed below, to be filled out by the parent.

DEPARTMENT OF INDUSTRIAL ARTS
Baker Elementary School
Evansville, Indiana
HOME MECHANICS

Student..... Date.....
Address.....
Project.....
Brief description of work done.....
.....
.....
.....
Quality of workmanship:
Poor... Fair... Good... Superior...
Parent .....
Instructor .....

In many cases it is best if the instructor visits the home both during and at the completion of the job.

WHITTLING-JACKKNIFE TECHNIQUE

W. BEN. HUNT

Hales Corners, Wis.

(*Continued from page 341 of the October, 1942, issue*)

It may interest some to try their skill at whittling on the book ends shown in Figures 96 and 97. These are rather modern and easy to whittle. Cut out the silhouettes as shown in previous projects and rough out the general outline first. See full-size patterns in Figures 98 and 99. All the muscles are sharply defined and conventionalized which makes the whittling rather simple. The hair, such as the mane of the horse and the heavy wool of the buffalo, is shown in smooth masses.

Both of these book ends look better when sanded down carefully.

The horseshoe back shown in Figure 96 is the only realistic part of these book ends.

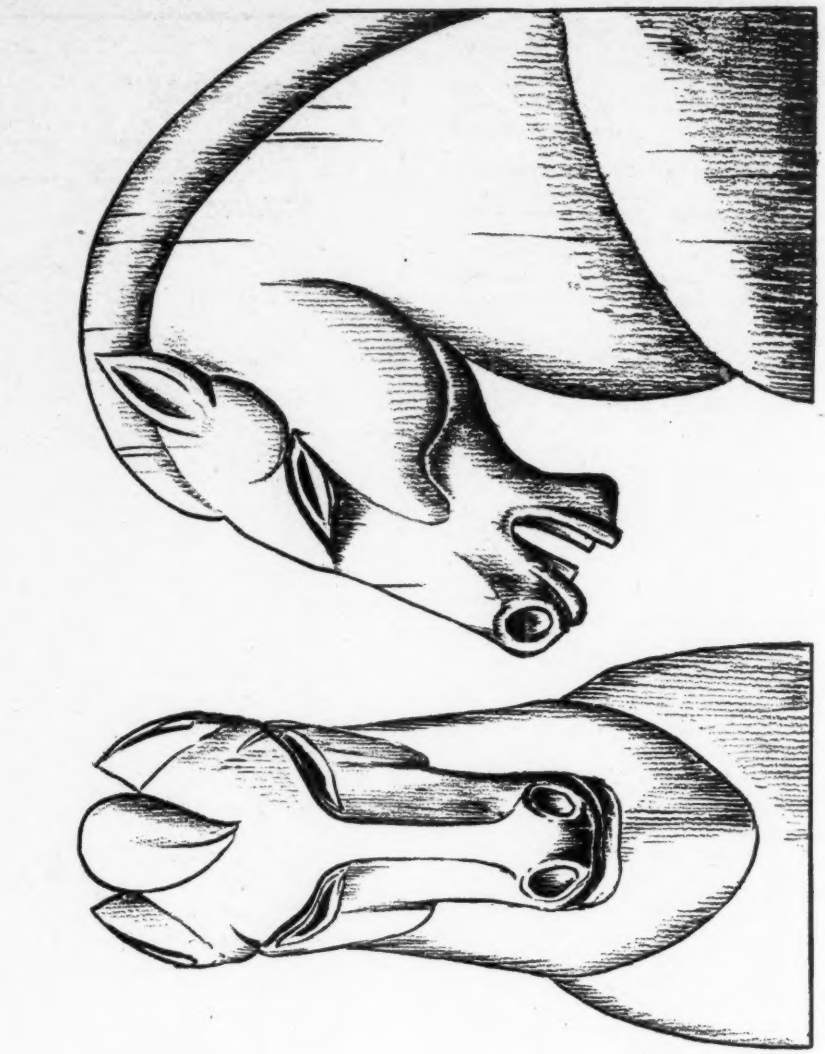
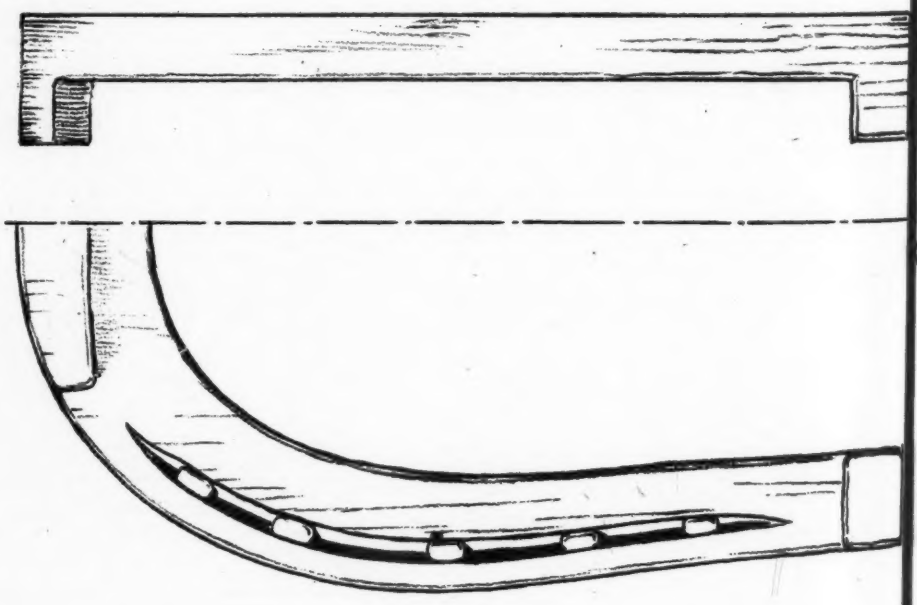


Fig. 98. Full-size pattern of horse-head book ends



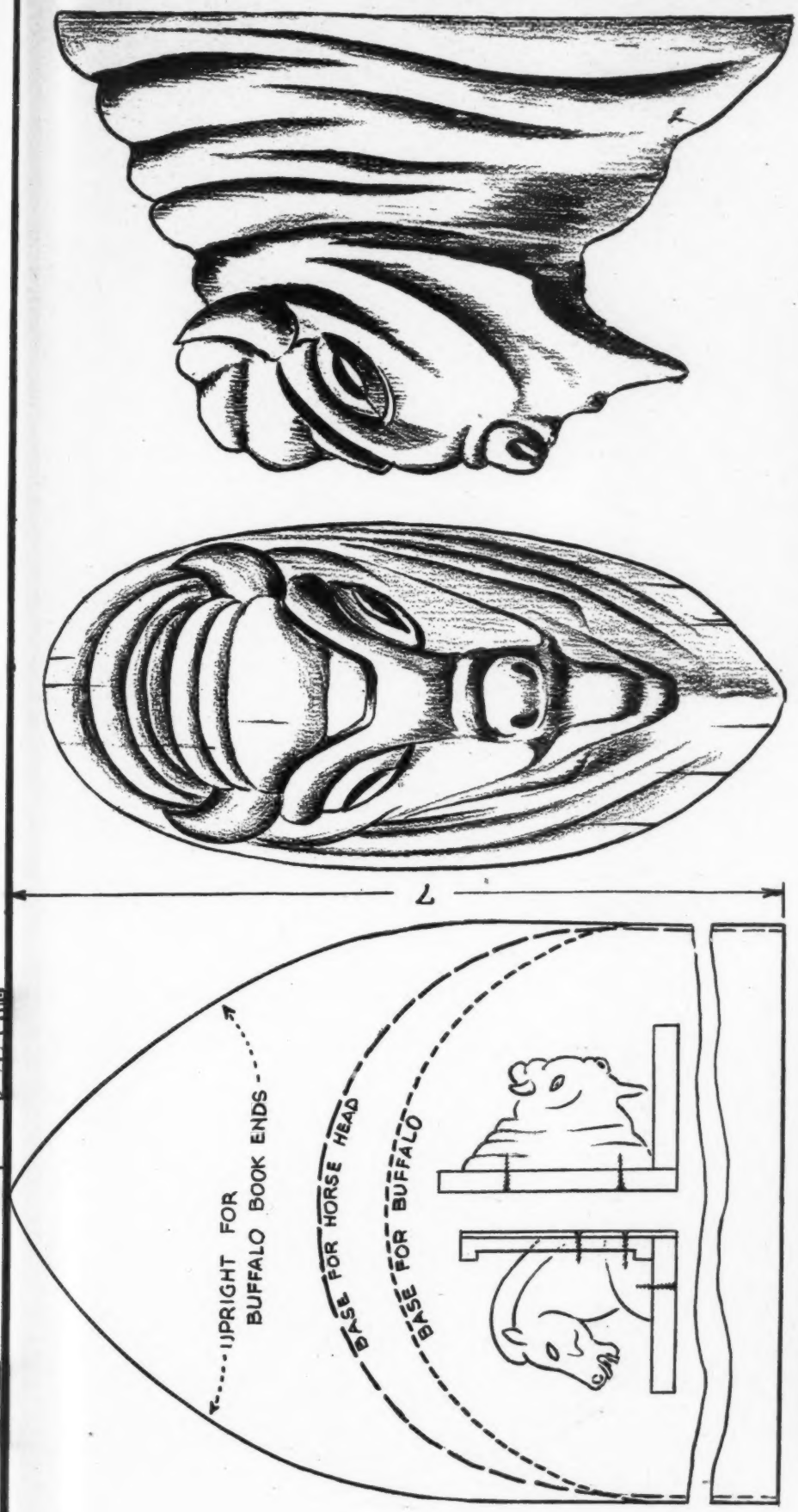


Fig. 98. Full-size pattern of horse-head book ends

These are sawn out of a 7/8-in. or 3/4-in. piece of board, as shown in Figure 99.

Figures 96 and 97 show the finished assembly of the book ends, and Figures 98 and 99 show the detailed assembly.

In order to give weight to the book ends, holes should be bored into the back of the buffalo head and in the bottom of the horse head, and these should then be filled with lead or babbit.

Fig. 96. Horse-head book end

The horse-head book ends each consist of four pieces — the head, the horseshoe, the backing for the horseshoe, and the base. The different parts should be glued together and also fastened with flathead screws. The screws should be countersunk and the countersunk holes above the screwheads filled with plastic wood. If felt is glued to the ends and bottom of base, the screws may be left flush.

When nice clear-grained wood is used, a light or dark stain, depending upon the taste

Fig. 97. Buffalo-head book end

of the owner, may be used. After this has dried, either dull or glossy varnish should be applied.

If the wood is not so good, two or three coats of cream or ivory enamel will give the book ends the appearance of fine china. Then glue the felt to the bottom and to the side that will be next to the books, and a set of rich-looking book ends will be the result.

A MAKE-UP KIT

G. G. STARR

Superintendent of Schools
Arcanum, Ohio

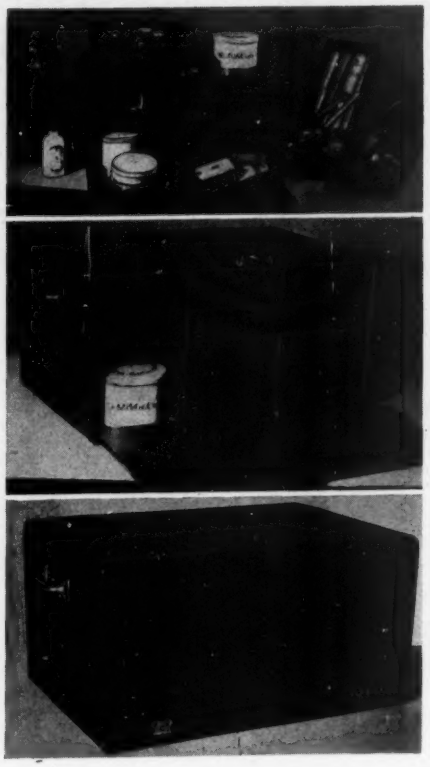
The make-up of the cast for a dramatic or musical production presents a problem in many schools. The director has been busy for weeks directing the cast and securing the scenery, costumes, and stage properties. Almost unexpectedly, a day or so before the night of the performance, the question of the make-up for the cast arises.

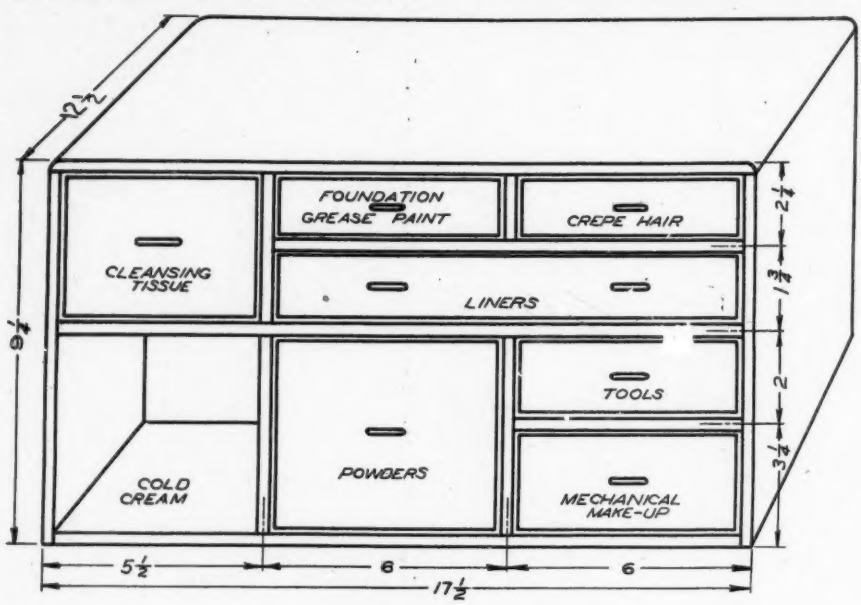
In a majority of schools some make-up supplies from other shows may be found somewhere around the building, perhaps haphazardly kept in an old shoebox. A quick inventory shows that many items are missing and that the available supplies are not in a very good condition.

In the midst of his many other duties the director must then take time out to purchase the much needed make-up supplies. Such was the experience at the Arcanum School until a few years ago when the make-up kit, illustrated and described herewith, was made by the industrial-arts department. This general kit which is available to all the organizations of the school has proved to be both economical and convenient.

Before starting such a kit, the first step should be the listing of the make-up supplies which will be needed. The quantity and variety of the supplies will be determined by the size of the school and the number of the presentations.

For the local school the following items have proved sufficient: cleasing tissue for removing make-up; theatrical cold cream for laying foundation and removing make-up; foundation grease paint (large sticks) in white, brown, black, vermillion, juvenile, robust, and sallow skin; lining colors (small sticks) in medium gray, light brown, dark brown, medium blue, and carmine; face powders (½ lb. cans) in white, pink, brunette, and rachel — mixing the colors to obtain any other shades needed; crepe hair (1-ft. lengths) in white, light gray, iron gray, light brown, and black; tools including scissors, comb, powder puffs, and make-up brush; and mechanical make-up including nose putty, blackout wax, clown white, pot rouge, spirit gum, alcohol, and adhesive.





Make-up kit

These supplies have been placed in appropriate groups, so that they can be kept together in individual compartments in the kit for convenience in checking and using. Also, it is easier to keep the supplies in better condition. For example, it prevents such items as powders and creams from getting mixed.

After the number of groups of make-up supplies and equipment have been determined, and the items which go into each compartment have been decided, it is an easy task to draw plans for the kit.

The kit shown in Figure 1 has eight compartments, one for each of the groups. Figure 2 shows where the various groups are stored.

The outside case of the kit was constructed of ⅜-in. plywood, while the drawers were made of ⅛-in. masonite. The dimensions of the outside of the case are: length, 17½ in.; width, 12½ in.; and height, 9¼ in. There are seven drawers in the kit. One compartment was left open for storing the cold creams which come in 1-lb. cans. The drawer for the liners has been divided into a number of compartments for storing odds and ends.

The drawer handles were made by gluing pieces of dowel rods to the fronts of all of the drawers.

The portable kit, with its hinged door on the front securely locked, is placed in the principal's office so that it is ready to hand for the next performance. After it has been used, the supplies are carefully checked, and missing items are replaced so that the kit is ready for the organization that makes use of it next.

This home-constructed make-up kit has been a real boon to us and it may be made to fit the requirements of other schools as well.

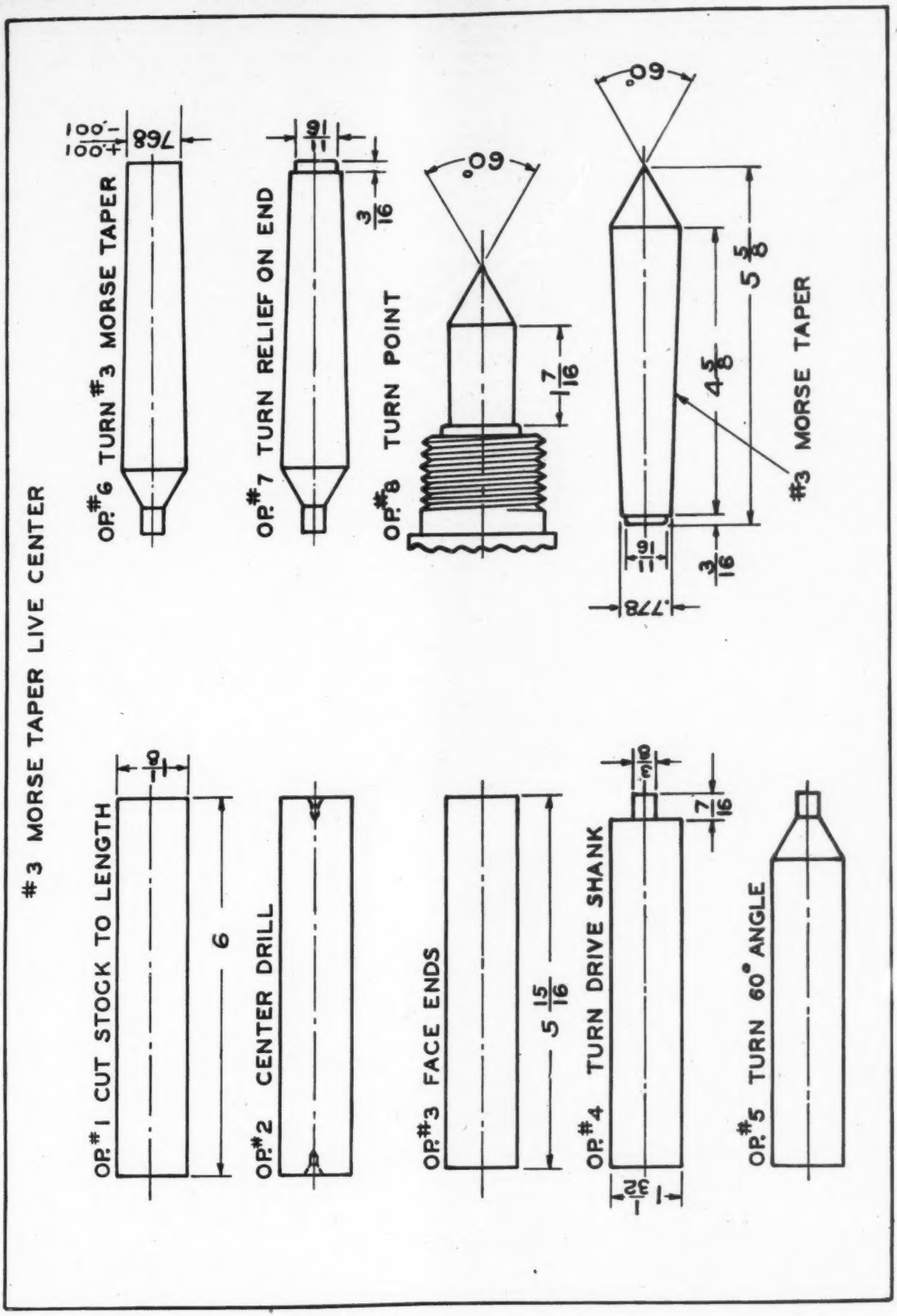
LATHE CENTERS

BERNARD S. LUSTIG

Milwaukee Vocational School
Milwaukee, Wis.

The impact of the national emergency upon the work of the school machine shops is daily forcing revisions in procedures. Equipment is being used more intensely, which naturally causes more *wear and tear* than in prewar days. Rapid student turnover, and a student body composed of many who normally are not mechanically inclined, has resulted in the condition in which a large portion of a typical machine-shop class is made up of inexperienced trainees. In such a setup, the *tear* influence is greater than the *wear* influence. Aggravating the wear and tear problem is the fact that replacements are not available, or, at best, available only after considerable delay. In some cases shop projects can be devised to minimize the effects of hard usage, and still retain the elements of instructional value essential to a shop project.

The turning of lathe centers, hard and soft, is a project that merits consideration by every shop instructor. This project is a desirable one from several angles, in that it replaces wornout equipment, does not require much material, does not require particularly hard-to-get material, stores easily, and provides excellent opportunities for instruction on equipment found in every school machine shop. A machine-shop instruction sheet drawn upon the following manner is a teaching aid for this project.



Operation sheet — lathe centers. Bernard S. Lustig

Turning a Live Center

Objective: To turn a live center for use as a replacement part.

Tools, equipment, and materials: Lathe, lathe dog, cutting tools, machinist ruler, outside calipers, combination center drill, dial indicator, Morse No. 3 taper ring gauge, and cold-rolled steel.

Operation steps: (1) Select C.R.S. of required diameter and cut to length. See Operation No. 1.

2. Drill center holes. Step No. 2.

NOTE: If more than one center is to be made, the length of stock and depth of center holes must be identical on all pieces.

3. Face ends of stock. Step No. 3.

4. Rough turn stock to 1 1/32-in. diameter. See Step No. 4.

NOTE: Check work at this point for alignment of centers.

5. Turn stock to 1-in. diameter.

6. Turn right end of stock to ⅜-in. diameter. Step No. 4.

NOTE: This part is to serve as a seat for the driving dog during subsequent operations. The shoulder is shown as being square but this is not necessary.

7. Rough turn 60-deg. center angle. Step No. 5.

NOTE: The compound is set for this operation by swiveling it 60 deg. from a position perpendicular to the bed. The tool is hand fed in an outward direction.

8. File a flat on the ⅜-in. diameter and remove work from machine.

NOTE: This flat is to serve as a seat for the dog setscrew.

9. Ask the instructor how to calculate the offset and move the tailstock the required amount toward the operator.

NOTE: A dial indicator should be attached to the tool holder, with the contact pin just touching the side of the tailstock body, for accurately measuring the amount of offset.

10. Rough turn the taper for a distance of about 2 in. See Step No. 6.

NOTE: The tool must be set exactly on center.

11. Take a light finish cut on the taper.

12. Test the taper.

NOTE: Three chalk lines should be drawn lengthwise on the taper cut for testing. A taper ring gauge (a good taper sleeve will serve if no gauge is available), lightly turned on the work, will show contact over the entire cut if the offset is correct. Contact on onlv the small end of the cut indicates insufficient offset. Use an indicator for adjusting incorrect offset.

13. Rough turn the taper to ¼ in. from the 60-deg. center angle.

NOTE: An easy way of setting the tool so it will run out at the desired point is bv moving the tool in at the ¼-in. point and noting the cross-feed dial graduation at the instant of tool contact with the work. The tool is then withdrawn, moved to the tailstock end, returned to the same dial graduation for the rough cut.

14. Finish turn the taper. Step No. 6.

15. Relieve the small end of the taper. See Step 7.

16. Form the 60-deg. end of the center. Step 8.

NOTE: In this operation the work is held in the spindle of the lathe. The position of the tool and compound is the same as when the center was rough turned in Step 5.

17. Check the center angle with a 60-deg. center gauge.

This project can be developed so that it includes the use of a taper attachment, and also the manufacture of hard centers by either method of taper turning. If hard centers are contemplated, the project provides an opportunity of impressing upon the student the need for allowing grinding stock on the rough-turning operations. It also provides an excellent opportunity for taper grinding on the cylindrical grinding machine or lathe with tool-post grinder.

An interesting bench project in connection with the turning of lathe center is the construction of a small driving dog to be fitted to the ⅜-in. turn. The use of this dog provides an opportunity of showing how work can be driven by a bolt passed through a slot from the back of the driving plate.

MUSIC STAND

C. F. ZAENGLEIN
High School
Circleville, Ohio

Last year our high school band was badly in need of metal music stands. We decided it would make an excellent project for our advanced metalwork classes, as it involved sheet-metal work, plumbing, forging, electric welding, bench metalwork, spraying or painting, etc.

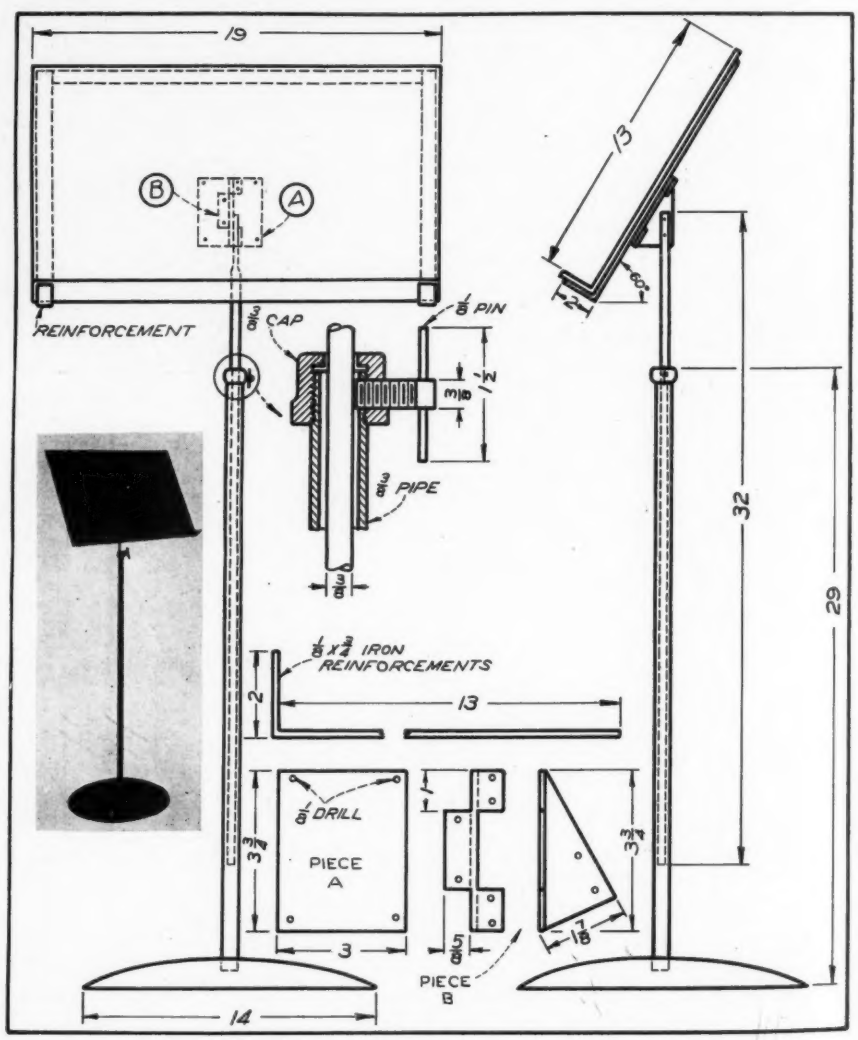
Nearly all the material was procured from the junk dealer. Thirty-two stands were made at a cost of less than 75 cents each. Steel disks from discarded disk harrows served as the bases. A ⅜-in. used gas or water pipe was used as the stem; a ⅜-in. cement reinforcement steel rod was just the thing for the adjustment rod; and the top was made from 20-gauge black iron, which was riveted to ⅛-in. mild steel plate.

The music stand is adjustable for both standing and sitting positions. The music holder at the top is not adjustable to slant, which adds to the life of the stand. We decided an angle of 60 deg. would be satisfactory.

Each student was assigned to one specific job throughout the whole construction period, for we have found it to be the most successful method for uniformity, in quantity production. The foreman of the group was assigned to make drawings of the various parts for each student.

Two jigs were made, one for welding the gas pipe perpendicular to the base, and the other for the purpose of giving a uniform slant to the top of the music stand.

The bases were first preheated slightly before welding to the pipe and then allowed



Music stand

to cool in center at weld, keeping the outer edges warm to prevent cracking. One end of the gas pipe was threaded for a ⅜-in. gas cap fitting, which was then center punched and drilled for the ⅜-in. steel adjusting rod. After the cap fitting was securely attached to the end of the pipe, a hole was drilled and threaded in the side of the cap for a ⅜-in. thumbscrew, as shown in the enlarged section on the working drawing. One end of the steel rod was forged flat for riveting to the steel plate.

The 20-gauge sheet metal is cut to the required size, drilled, and then riveted to the ⅛ by ¾-in. reinforcing strap. The strap iron pieces are set in about ⅛ in. from the outside edges of the sheet metal, which is then flanged around the edge of the strap iron, making a nice smooth edge. A double seam is put on the lower outside edge to reinforce and make it smoother. The music stand is then drilled and riveted to the square steel plate.

The assembled stand should be checked and filed smooth on all edges and finished smooth with emery cloth for enameling.

TEACHING AIDS AND DEVICES

CHARLES H. SECHREST
Teacher of Industrial Arts
Ferry School, and
Directing Teacher
Wayne University
Detroit, Mich.

The author of this series of articles does not claim that all of the aids and devices presented in this series are original. He has found them all of value and wishes to pass them on to other teachers hoping that they may find them of use and service.

Window-Shade Drawings

It is necessary quite frequently to place a large drawing on the blackboard two or three times during a semester. If it is the drawing of a core job or typical job that merits teaching each semester, it is necessary to make the drawing each time that the lesson is presented. A great deal of time and effort can be saved if these jobs are drawn with India ink on

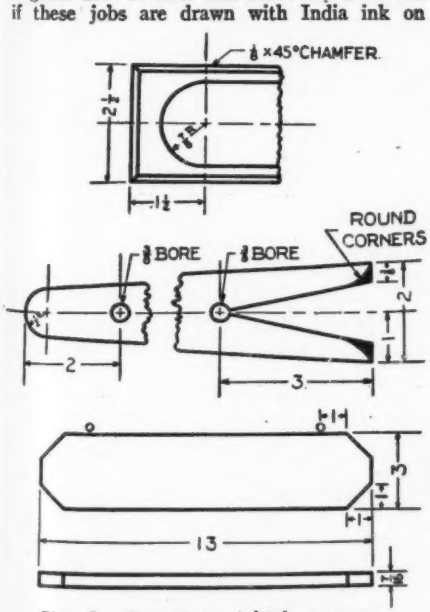
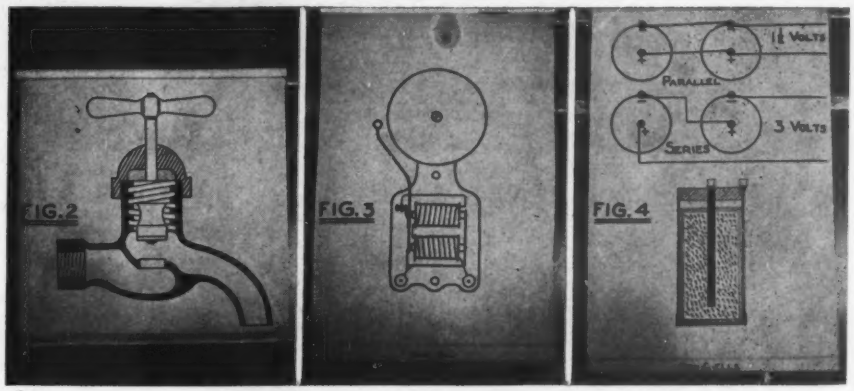


Fig. 1. Drawings which appear on one of the window shades



Other window-shade drawings

common window shades. To make a finished drawing may take extra time but the time spent is saved in the future. In Figures 1, 2, 3, and 4 are shown several drawings that have been used successfully for several years. They are only suggestions. The possibilities of window-shade drawings are unlimited. These drawings were made on window shades that had been discarded. The upper part of the window shade was used because it was in good condition. Wallpaper cleaner was used to clean them. On new window shades a blackboard eraser that contains chalk dust may be rubbed over the surface of the window shade that is to be inked. It was found that this makes the ink take or adhere better to the surface, just as it is sometimes necessary to dust the surface of tracing cloth before inking it. It is advisable to have all of the window shades the same width so they are interchangeable. A storage place may be provided for them and only one window shade put up at the time it is to be used. In this manner they will not become dusty, faded, or worn so soon. Suitable window-shade rollers can be purchased at five-and-ten-cent stores.

Several drawings may be placed on the same window shade as shown in Figure 1. The drawings on this window shade are used as an aid in teaching pupils to read blueprints. Each drawing is an exact reproduction of a blueprint or part of a blueprint as used in the shop. For example, several blueprints of the two-view drawing shown at the bottom of the window shade, Figure 1, are passed to the pupils and the group discusses it. The teacher uses the window-shade drawing as his blueprint to guide the discussion. The middle drawing and the top drawing are exact reproductions of details as shown on two other blueprints used in the shop. There is still room on this particular window shade to place another drawing.

In Figure 2 a drawing of a compression faucet is shown. A drawing of a drain trap and a drawing of a flushing tank are included on this same window shade. The drawing of the doorbell, Figure 3, has been found to be a great aid in the demonstrating operation of a doorbell. The window-shade drawing, Figure 4, is an aid in explaining the parts of a dry cell. A series connection and a parallel connection of two dry cells are also shown.

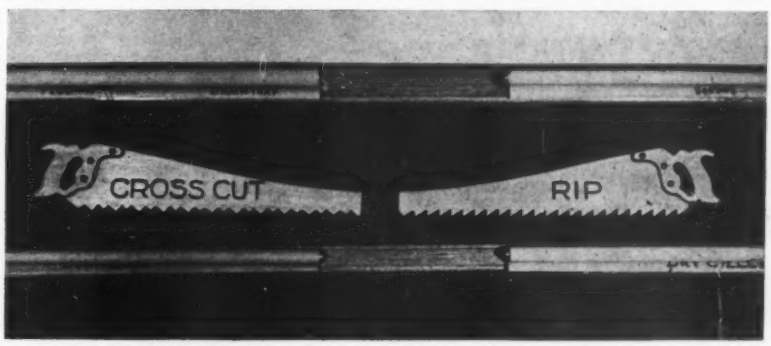


Fig. 5. Handsaws

The necessary equipment for making window-shade drawings is small. A pencil compass may be used for drawing circles and arcs and a yardstick may be used for drawing straight lines. Different sizes of speed-ball pen points may be used to vary the weight of lines. The procedure of making the drawings is simple. A suitable surface on which to work should be provided. A desk top is an ideal surface because the window shade can be hung over the front and the back of the desk. Determine how many views or drawings are to be placed on the window shade and then block out each section. The number of views or drawings is limited by the length of the window shade and by the size of the drawings. It is desirable to make all drawings as large as possible, so the students can see them readily during the discussion. The doorbell, Figure 3, is about 16 by 36 in. The dry cell, Figure 4, is 10 by 20.

Make the pencil drawing with a 3H or 4H pencil. Pencil marks may be removed with a common eraser, but do not erase any more than is necessary because the marks show badly sometimes. After the drawing is completed with pencil it may be inked with

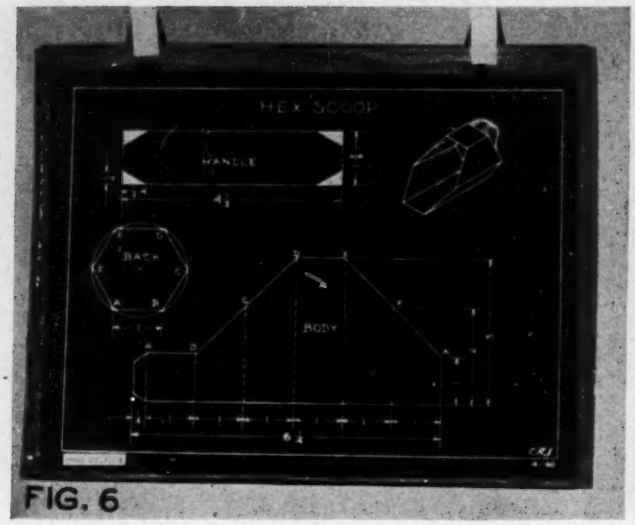


FIG. 6

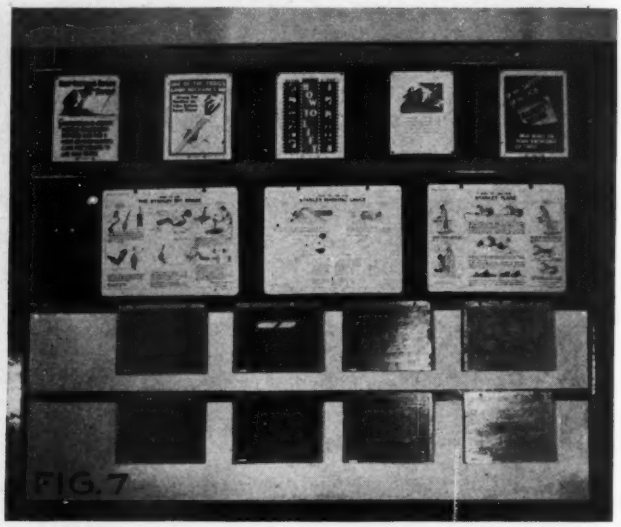


FIG. 7

Display blueprints

India ink. Speed-ball pen points Numbers 0, 1, and 2 provide enough variety of line weights for most drawings. Large circles and arcs may be inked freehand and an inking compass may be used for small circles and arcs. The yardstick used for drawing straight lines with the pencil may be used as a guide for inking straight lines.

The hem of the window shade for the stick may be sewed on a sewing machine before or after the drawings are made. The names of the drawings should be lettered on the hem as this indicates the drawings contained on a particular window shade without unrolling it.

Handsaws

One of the best teaching aids for showing pupils the difference between a crosscut handsaw and a rip handsaw is shown in Figure 5. These two saws are made exactly alike with the exception of the teeth. They are the same size as an ordinary 24-in. handsaw but the teeth are 1 in. wide. Also 7/16-in. basswood may be used for the saws and a regular handsaw used as a templet or pattern. The teeth can then be laid out one tooth per inch. After sawing out a sharp knife may be used to shape the crosscut teeth properly. The outline of the handle, the screws, and the name of the saw are drawn with a Number 2 speed-ball pen and India ink. After the ink has dried a coat of shellac should be applied. Do not brush back and forth over the India ink for it may streak. Lay the first coat on as when applying varnish. Additional coats of shellac or varnish may then be applied. Apply screw eyes and hang the saws in a suitable place.

Blueprints

Blueprints are used a great deal in the teaching of shopwork. One of the successful ways of keeping them in good condition is to mount them on some suitable backing. The blueprint shown in Figure 6 is mounted on ¼-in. plywood. Cut the plywood to the desired size, and then apply three or four coats of shellac to both sides of it. Shellac keeps the plywood from warping and also makes it easy to remove the blueprint when it is desirable to do so. Allow ample time for the shellac to dry before pasting on the blueprint. Ordinary flour paste may be used. Apply a heavy coat of paste to the plywood with a brush and thoroughly wet the blueprint with water. Place the blueprint in position and brush out the wrinkles with a clean counter brush just as a paper hanger brushes out the wrinkles in wallpaper. Only paste on one blueprint and allow it to dry in a flat position before pasting another blueprint on the reverse side. It is best to put a blueprint of some other job on the reverse side. After both sides are dry the names of the blueprint may be typed on paper, cut out, and pasted on the opposite side from the blueprint. In Figure 6 is shown the blueprint of a metal scoop. Notice in the lower left-hand corner, the name of the blueprint that has been pasted on the reverse side. Apply a coat of shellac to the finished blueprints. This will help to keep them clean.

When a blueprint becomes soiled or it is desirable to remove it, the old blueprint will peel off very easily. Another coat of shellac should be applied to the plywood before pasting on new blueprints.

In Figure 7 is shown how blueprints and other shop information may be displayed. The holes by which the blueprints are hung should be an equal distance apart on each blueprint so that they are interchangeable.

ELECTRICAL TEST BENCH

WAYNE GETMAN
High School
Phoenix, N. Y.

The teaching of general electricity seems to be more difficult than the other popular subjects in the industrial-arts program. Certain electrical phenomena are difficult for many students to understand, and there seems to be a shortage of projects within the

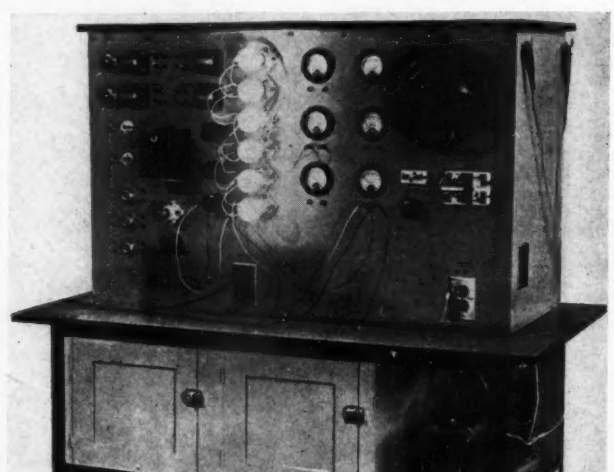


Fig. 1. Test panel and bench

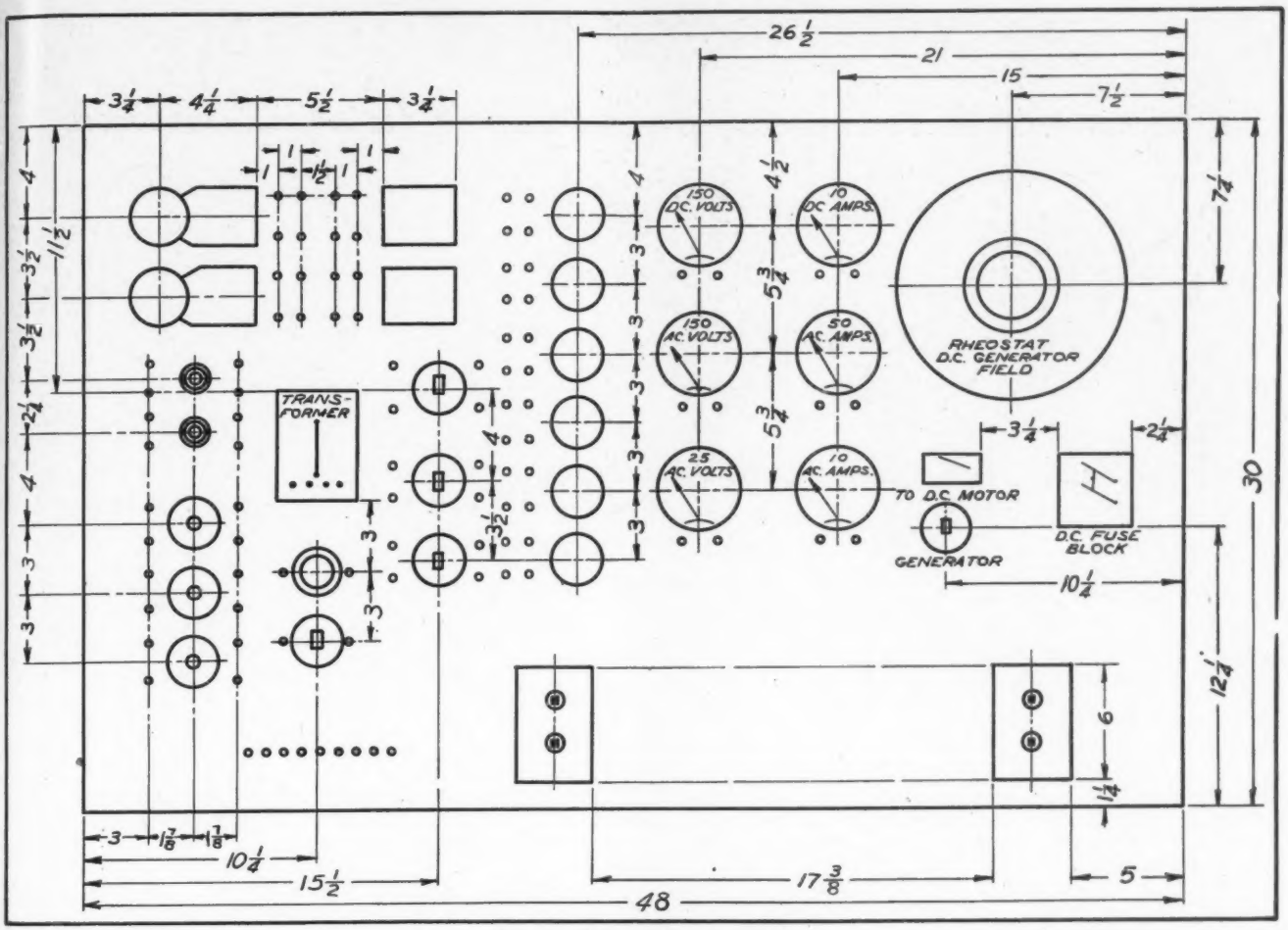


Fig. 2. Electricity test panel

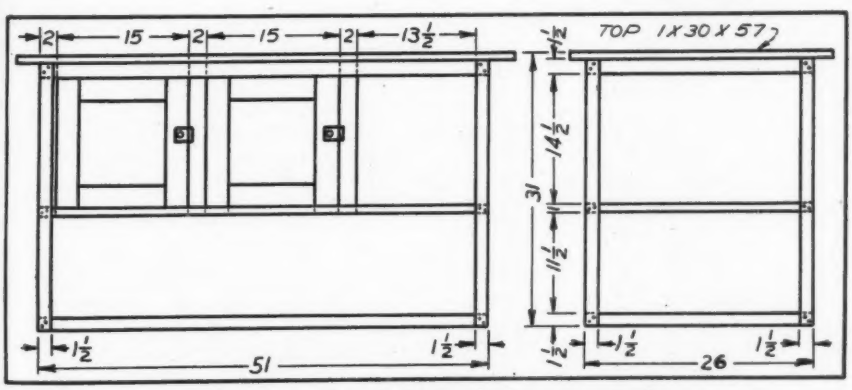


Fig. 3. The bench beneath the test panel

capabilities of ninth- and tenth-grade students that offer sufficient appeal to warrant construction.

The electrical test bench described herein and illustrated in Figures 1 and 2, quite efficiently meets the greater portion of the requirements in experimental electricity, which forms an important part of any good electricity course.

The test panel, Figure 2, was made first and was in constant use while the rest of the bench was under construction. It is made of ⅜-in. plywood, reinforced at top and bottom with 1-in. angle iron. As storage space is always at a premium, shelves were placed on the back side. To protect the wiring, ¼-in. plywood was inserted in grooves at the ends so that the shelves just butt against the plywood, which forms a backing and perhaps unfortunately conceals the wiring. Unfortunately, because the wiring of the panel might be an efficient teaching aid.

The frame of the bench was made with ⅛ by 1½-in. angle iron. Corners were mitered and ground for welding, but after all joints were riveted, welding seemed unnecessary for a sufficiently strong assembly. The addition of shelves and paneling also added greatly to its rigidity. All shelves, the top of the bench, the top of the panel, and the ends were constructed with whitewood; all edge to edge joints were glued. Fir plywood, ⅜ in., was used for paneling the back and ends of the bench.

The following list comprises the electrical equipment incorporated in this test bench:

2 buzzers
2 bells
2 miniature sockets
3 push buttons
1 variable transformer
6 porcelain receptacles
2 single-pole toggle switches
2 three-way toggle switches
1 double-pole, single-throw, fused, knife switch
4 knockout boxes
4 double base plugs and plates
1 d.c. voltmeter, 0–150 volts
1 a.c. voltmeter, 0–150 volts
1 a.c. voltmeter, 1–25 volts
1 d.c. ammeter, 0–10 amperes
1 a.c. ammeter, 0–50 amperes
1 a.c. ammeter, 0–10 amperes
100 insulated radio jacks
1 500-watt d.c. generator, complete
1 field rheostat for above
1 storage battery

COMMON WOODS — A TESTING DEVICE

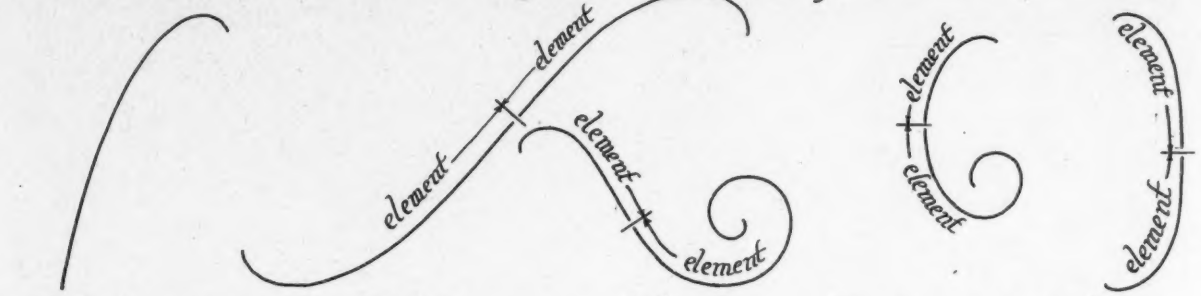
ROBERT E. OWEN
Instructor Industrial Arts
High School
New Haven, Mich.

This device for showing common woods has proved to be very interesting as well as educational. Built primarily by the general shop boys as an added attraction for the annual shop exhibition, it afterward became an

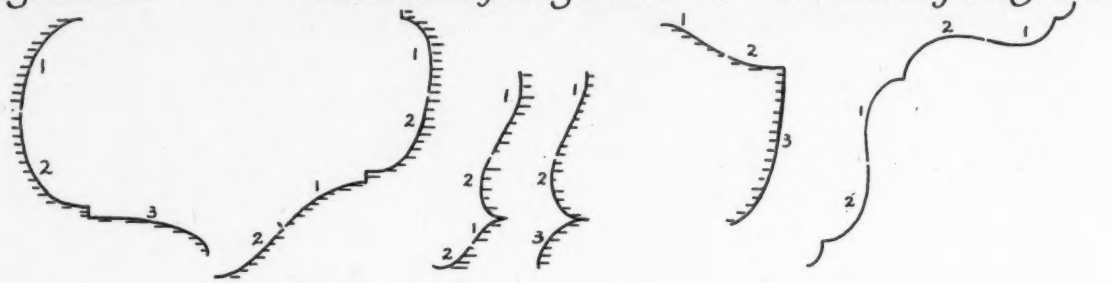
(Continued on page 408)

HOW MAY CURVES BE COMBINED?

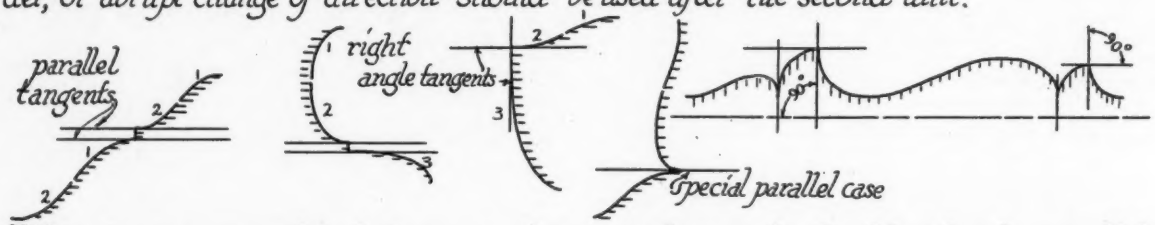
All curves start with a unit or single element, which is repeated in varied combinations.



Single element — Two elements forming "S" curve — Two elements forming "C" curve



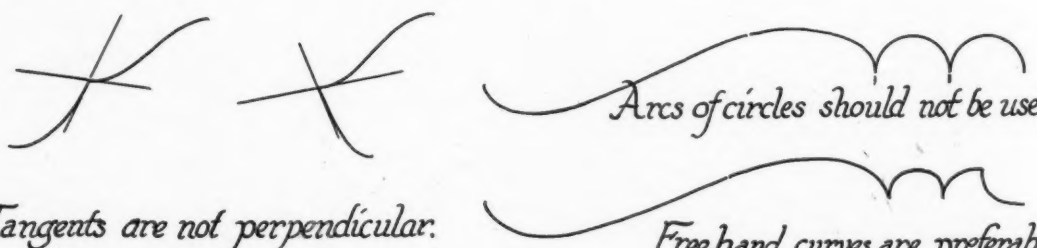
When more than two elements are used in sequence, a break of some sort – a bead, shoulder, or abrupt change of direction – should be used after the second unit.



When curves are combined, tangents drawn at their ends should either be parallel or perpendicular to each other, and to some axis or surface of the object on which they are used.

Avoid:

Continuous combination — Tangents of these curves are not parallel.



Tangents are not perpendicular. — Arcs of circles should not be used. — Freehand curves are preferable.

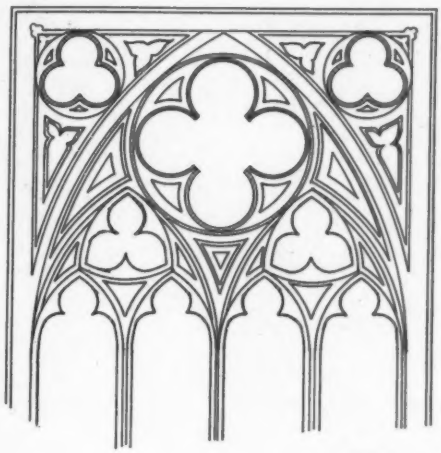
Plate 6. Continuation of design course by Burl N. Osburn, Director of Industrial Arts, State Teachers College, Millersville, Pa.

CAN THE CIRCLE BE USED IN DESIGN?

Ionic column

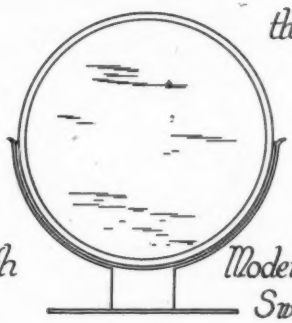
Humphrey Penn pewterer's touch

Gothic stonework



Imprint of the Grolier Club

Maiolica dish



Mirror with metal frame

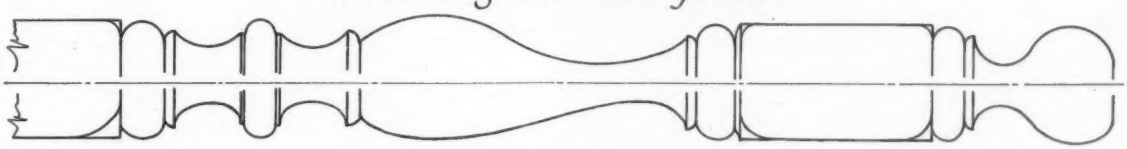
Modern Swedish

Chip carving from Early American box

The circle is the logical answer to many requirements of structure, form, and motion. Coins, buttons, tableware, and watch faces are examples of common articles whose convenient form is round. In three-dimensional form, bearings and baseballs attest to its necessity.

Example of Jacobean turning as an instance of a circle mis-used:

this side designed with arcs of circles



this side designed with free hand curves

Arcs of circles should not be used where traditional practice calls for free hand curves.

Plate 7. Design course by Burl N. Osburn, Director of Industrial Arts, State Teachers College, Millersville, Pa.

PLATE I SEA LIFE

THESE BASIC FORMS MAY BE USED
TO CREATE DESIGNS FOR MOST FISH

FEEL OUT THE
FORMS WITH
QUICK LIGHT LINES

THE AIM IS NOT
REALISM BUT TO
CREATE

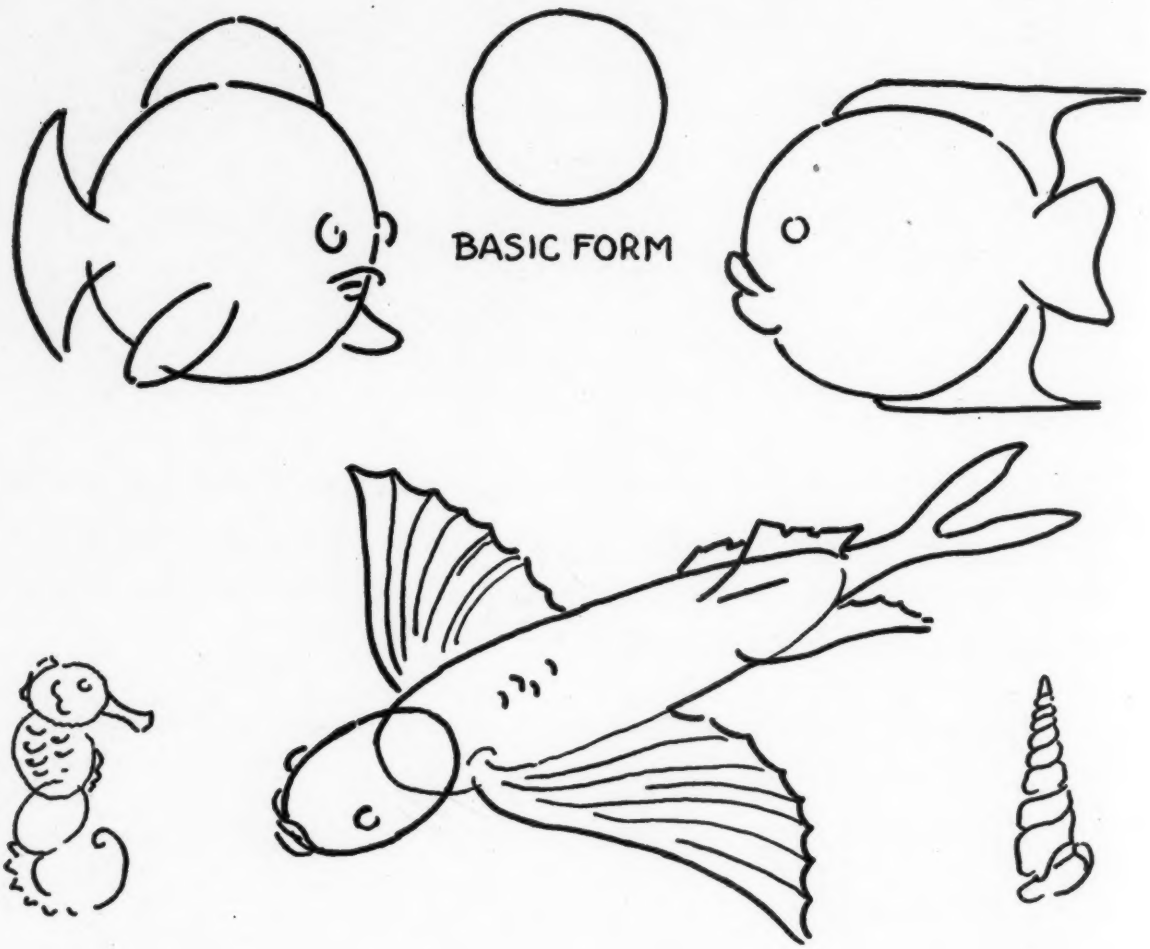


Plate 1. Creative design course by Richard E. Bailey, chairman, art department, Central High School, Providence, R. I.

PLATE 2
SEA LIFE
LET YOURSELF GO ! · START WITH THE BASIC FORMS AND ENRICH THE CONTOURS · ·
· BE CREATIVE · · FEEL YOUR DESIGN · MAKE IT AN EMOTIONAL EXPERIENCE
IF ART METAL IS THE · OBJECTIVE STRIVE FOR INTERESTING SILHOUETTE
IF YOU FEEL DISTURBED BY ANY PART OF THE DESIGN CHANGE IT

Plate 2. Creative design course by Richard E. Bailey, chairman; art department, Central High School, Providence, R. I.

(Continued from page 403)

excellent teaching aid in the school shop. Because of this novel way of learning to identify woods, more 4-H handicraft boys competed in the county achievement day wood judging contest than in previous years. Any device which helps to make learning fun, makes learning self-motivating.

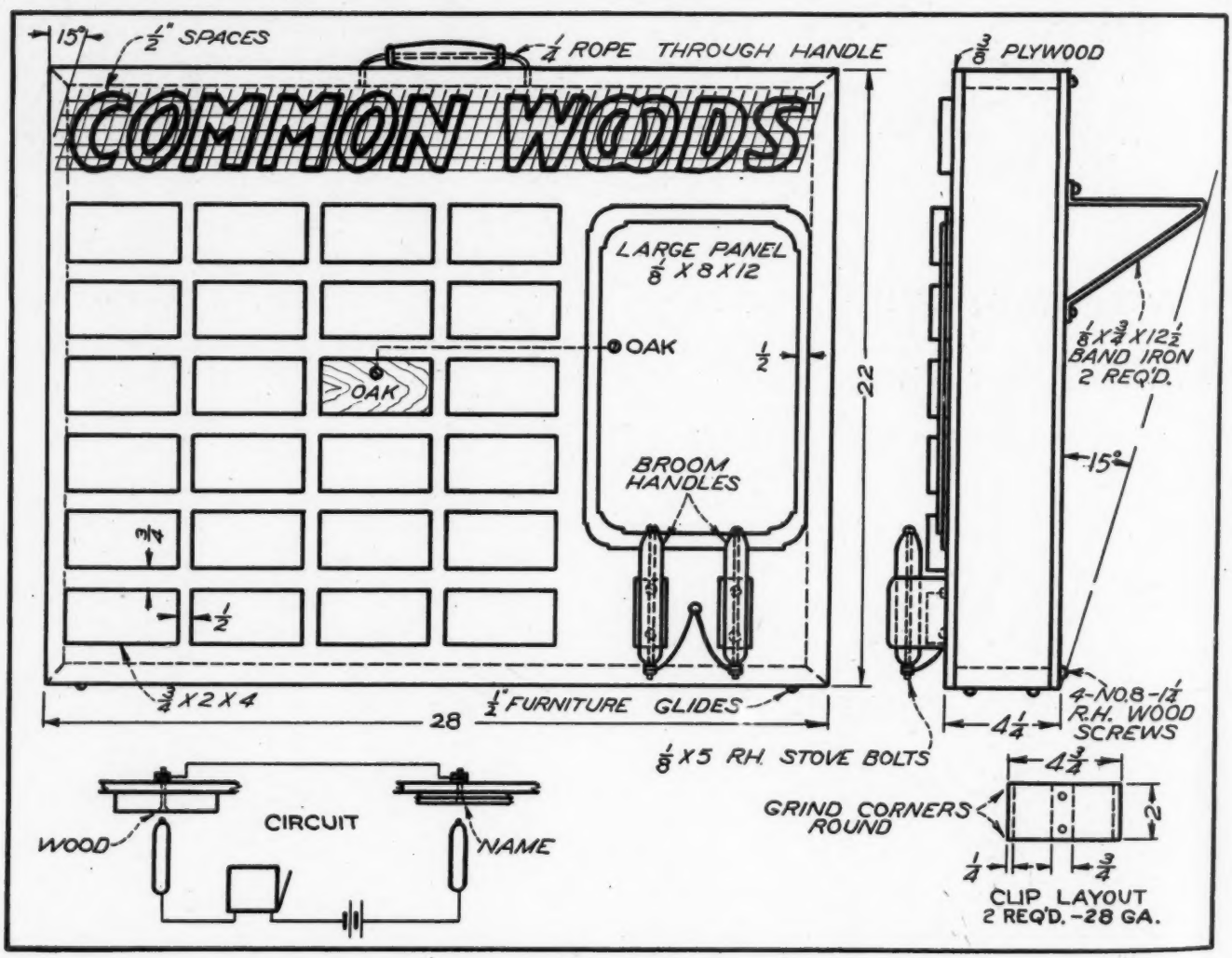
In the making of this teaching aid, care should be taken when selecting the wood samples. *Common woods* will vary somewhat in every locality. One should have in mind about two dozen kinds of hard- and softwoods most likely to be used by the students. The properties typical of each type of wood, such as knots, color, grain size, and texture, should be prominent in the relatively small samples.

To construct, mount the samples on a box panel with flatheaded stove bolts. These bolts also serve as terminals. A small title panel is then mounted at the side with flatheaded bolts beside each name forming the other terminal. Inside the box, the name plate terminal bolt is connected to the corresponding wood terminal bolt. The buzzer and batteries are connected in series with a contact pointer placed on the wood terminal while the other pointer is placed on the corresponding name plate terminal. This closes the circuit and the buzzer rings indicating the correct response.

All the connecting wires inside the box

Bill of Material

No. Required	*Name*	*Material*	*Size*
2	Box front and back	Fir plywood	⅜ x 22 x 28
2	Box sides	Yellow pine	¾ x 3½ x 22
2	Box ends	Yellow pine	¾ x 3½ x 28
1	Wood letters	Bird's-eye maple	½ x 2¾ x 24
24	Samples	Common woods	
1	Large panel	Mahogany veneer	¾ x 2 x 4
1	Small panel	Mahogany veneer	⅛ x 8 x 12
2	Pointers	Broom handle	⅞ x 7 x 11
1	Carrying handle	Hardwood	¾ x 4½
1	Fastening handle	Manila rope	¾ x 6
2	Tilting braces	Band iron	¼ x 18
4	Corner angles	Band iron	⅛ x ¾ x 12½
2	Pointer clips	Galvanized tin	⅛ x 8
2	Battery clamps	Galvanized tin	2 x 4¼ — 28 ga.
1	Connection	Fixture wire	2 x 7 — 28 ga.
24	Connections — woods to names	Annunciator wire	5 ft. 18 ga. 26 in. No. 18
1	Pointer wire exit	Socket bushing	
2	Supply current	Dry cells	⅛-in. brass
1	Response	Buzzer	1½ volt
4	Supports	Furniture glides	Low voltage
2	Pointer contacts	Stove bolts	½ in.
4	Fasten tilt braces	Stove bolts	3/16 x 5 r.h.
48	Fastening terminals	Stove bolts	3/16 x 1 r.h.
52	Support burrs	Washers	3/16 x 2 f.h.
50	Connecting wires	Burrs	3/16 in.
14	Fastening front	Screws	3/16 in.
4	Fastening back	Screws	1¼ in. f.h.
10	Fastening clamps and buzzer	Screws	1¼ in. r.h. ⅜ in. r.h.
16	Fastening corner angles	Screws	¾ in. r.h.



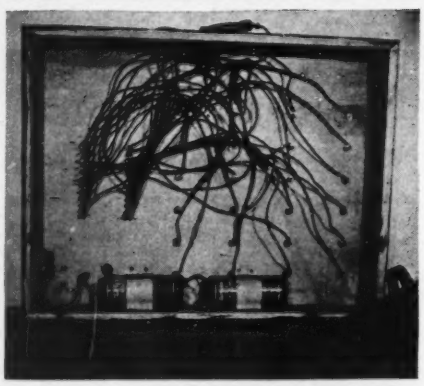
Electrical device for testing the student's knowledge about common woods

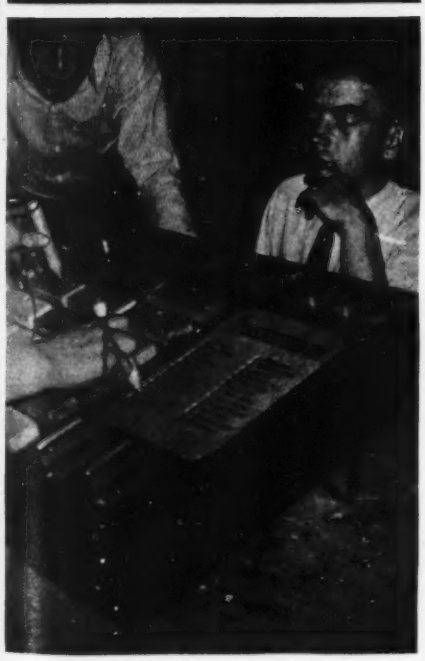
should be cut to maximum length, that is, the longest distance between the left-hand wood column and the right-hand name column. This will enable the instructor to remove the back cover and change the wood sample locations around frequently, thus minimizing the chances of learning the positions of the woods instead of the kinds of woods.

Lettering the names and instructions on the panels may be done with a speedball pen and India ink. First, however, the plywood panel should be well sanded and given a thin coat of shellac, then smoothed with worn No. 3/0 sandpaper so the ink will not be absorbed beyond the width of the letter strokes by the wood.

The lettering of the title "Common Woods," if a title is desired, is best to cut it out of bird's-eye maple. Then after painting the box medium or dark green, the wood letters may be mounted across the top with brads set below the surface. The filled holes resemble the bird's-eye figures if the letters receive a natural finish.

The completed panel is attractive and arouses a purposeful curiosity.





Front and back of testing board, and students taking the test

ACID BOTTLE HOLDER

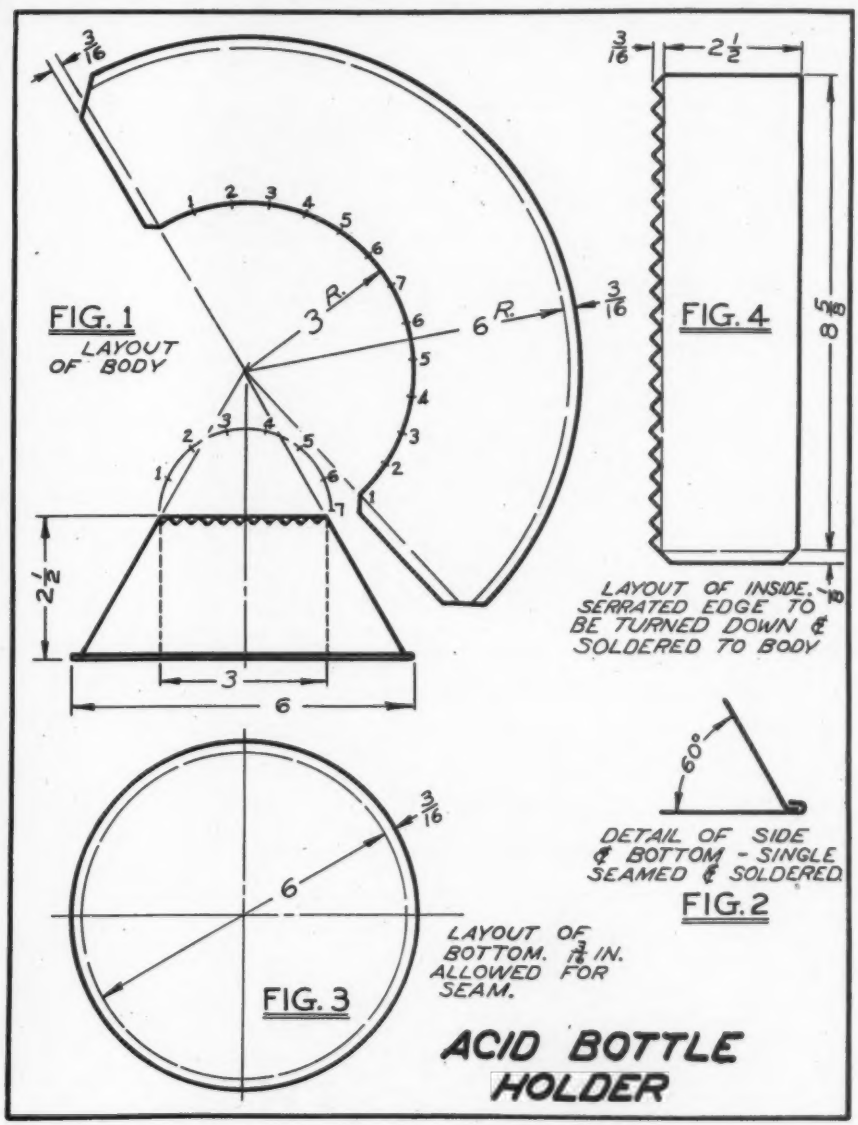
DAVID L. WATKINS
Garden City
Chester, Pa.

In teaching seventh-grade sheet metal I had trouble keeping the boys from upsetting the acid container, so it was decided to make a holder of some type that would be hard to tilt.

After deciding upon the size of the bottle, an inverted funnel was made of tin which fitted the bottle, as shown in Figure 5.

Fig. 5

Figure 3 shows the size of the bottom, with 3/16 in. for the single seam, and Figure 2

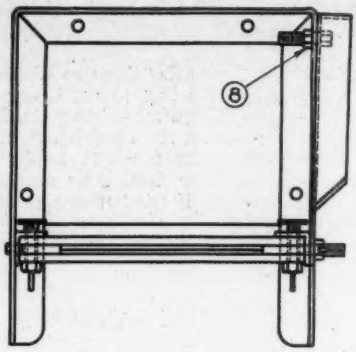


Details and layout of the acid bottle holder

shows how the bottom is seamed over the side and then soldered.

Figure 4 shows the size of the piece put on the inside to strengthen the holder and keep the bottle firmly in place. The 1/8-in. allowance at the end in Figure 4 is for soldering, and the scalloped edge is turned over and soldered to the outside of the holder.

This type of holder has now been in use for several years. It works very well and there are no more tipped acid bottles.



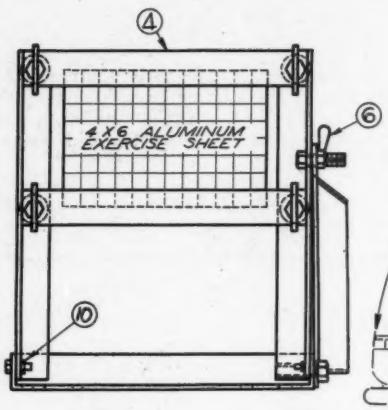
BILL OF MATERIALS				
DET.	NAME OF PART	REQ.	MAT.	SIZE
1	BASE	1	A.I.	1/8 X 1 X 34 3/4
	CROSS BAR	1	C.R.S.	1/4 X 3/8 X 8 3/4
2	UPRIGHT	2	A.I.	1/8 X 1 X 11 3/4
	CROSS BAR	2	C.R.S.	1/4 X 1 X 10 1/4
	CAP SCREW	1	STD.	3/8 X 1 1/2 - 16 N.C.
3	BRACE	1	A.I.	1/8 X 1 X 13
4	CLAMP BAR	2	C.R.S.	1/4 X 1 X 10 1/4
5	CLAMP SCREW	4	STD.	3/8 X 1 1/2 - 16 N.C.
	WING	4	C.R.S.	1/8 X 1 1/2 X 1 1/2
	DISK	4	C.R.S.	1 1/2 X 1/8
6	NUT	1	STD.	3/8 - 16 N.C.
	WING	1	C.R.S.	1/8 X 1 1/2 X 1 1/2
7	CAP SCREW	1	STD.	3/8 X 1 - 16 N.C.
8	NUT	1	STD.	3/8 - 16 N.C.
9	CAP SCREW	2	STD.	1/4 X 1/2 - 20 N.C.
10	NUT	2	STD.	1/4 - 20 N.C.

RIVETING FIXTURE FOR AIRCRAFT CLASSES

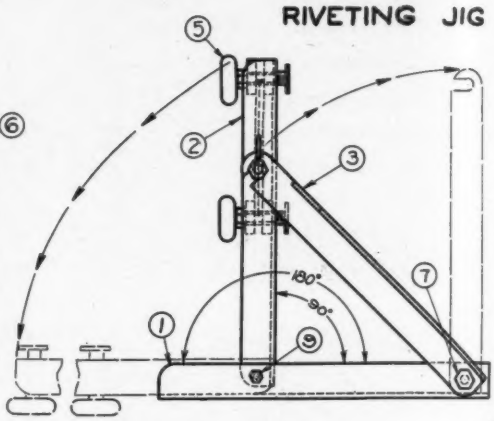
GEO. E. TABRAHAM

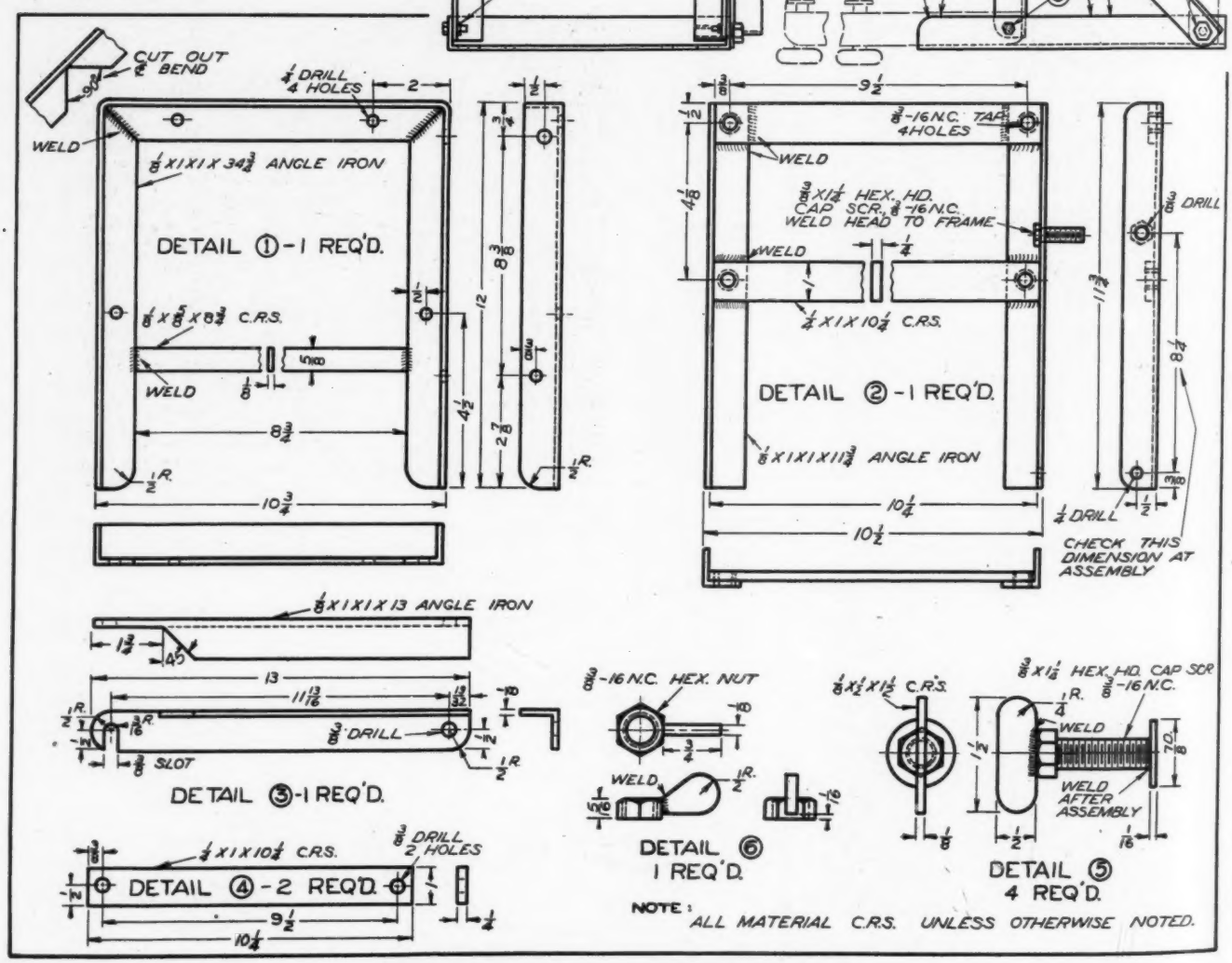
Supervisor, Aeronautical Activities
Detroit, Mich.

The riveting fixture presented herewith was devised for holding exercise plates in aircraft riveting classes. It has been found an excellent substitute for the hard-to-get vises, and it has proved adequate, efficient, inexpensive, and simple to make.



RIVETING JIG





Riveting fixture designed by Geo. E. Tabraham

Training student with Holgun Drill, Black & Decker's famous "Handful of Power." This future mechanic is drilling airplane wing panel at the Whitehaven Aircraft School, Whitehaven, Tenn.

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with the SAME TOOLS They'll Use TOMORROW!

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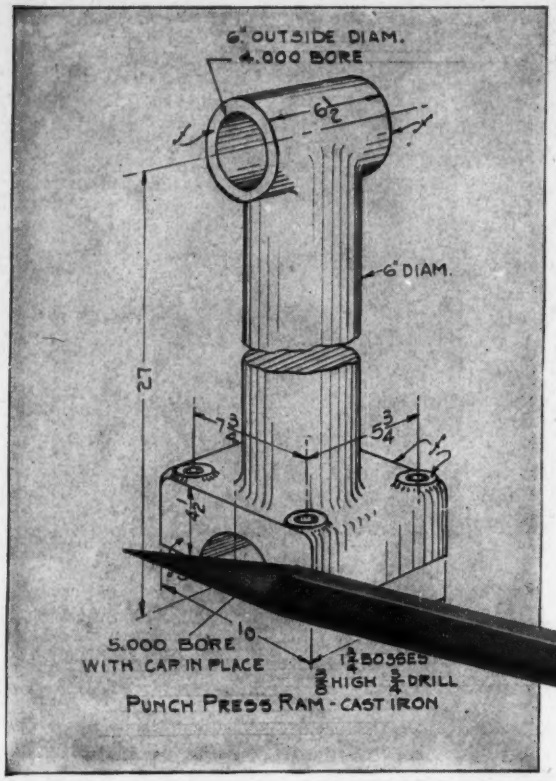

PROBLEM: Ask your students to draw the correct orthographic views of this Punch Press Ram. *Typhonite* ELDORADO degrees recommended: 3H and 4H.

SOLUTION: We'll send you a free blueprint showing the problem's solution if you write to address at right within 30 days, specify Blueprint No. 128-J11.

LET THEM TRY THEIR HAND AT THIS ONE—

Two immediate problems are solved when you give your students this assignment. First, it answers the question, "what next?" Second, it's an actual shop problem that will click with your class.

Just as the assignments and guidance you give your students train them for actual practice, so do the tools they use. It's good foresight to start them early using *Typhonite* ELDORADO pencils. This great professional pencil gets them in the habit of producing "advanced" drawings that make impeccable blueprints.

SCHOOL BUREAU, PENCIL SALES DEPT.
JOSEPH DIXON CRUCIBLE CO.
JERSEY CITY, N. J.

MOLDING PLASTICS IN HIGH SCHOOL

DALE PETERSON
Formerly Teacher of Woodwork and Hobbies
Irving High School
Salt Lake City, Utah
Now in the U. S. Navy

(Continued from page 295 of the September, 1942, issue)

Making Dies

Two general types of molding dies are in use in the plastics industry. The first is the injection type, shown in Figure 1, which requires considerable and expensive equipment. Such equipment may become available to school shops later on, but it is still in the undeveloped stage.

The second is the compression type shown in Figure 2. This requires less skill to construct and operate, and it can be varied somewhat in its construction.

The *flash* type of compression mold, shown in Figure 3, is so constructed as to allow any excess plastic powder to be forced out or flow out of the mold. This flow of excess plastic is caused by the closing action of the dies. Due to this excess plastic material, there is always a *fin* or *flashing* left clinging to the mold.

Some types of resins or plastics cannot be effectively molded in flash-type molds. This is particularly true of some of the pure resins, which have such a low viscosity as to flow readily out of the mold, leaving insufficient plastic material within the mold to maintain an adequate molding pressure. Such moldings,

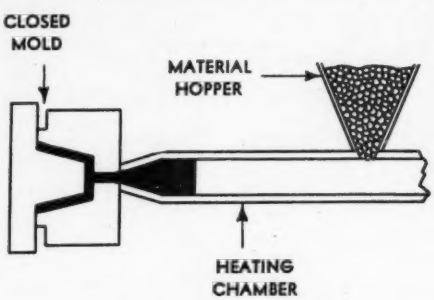

Fig. 1. Injection molding
— Courtesy, Bakelite Corporation

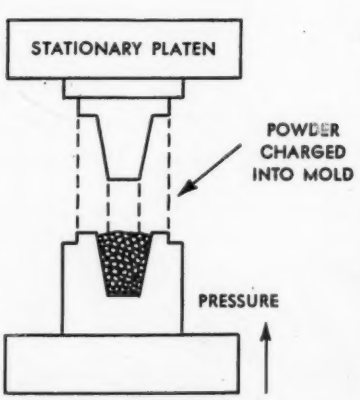

Fig. 2. Compression molding
— Courtesy, Bakelite Corporation

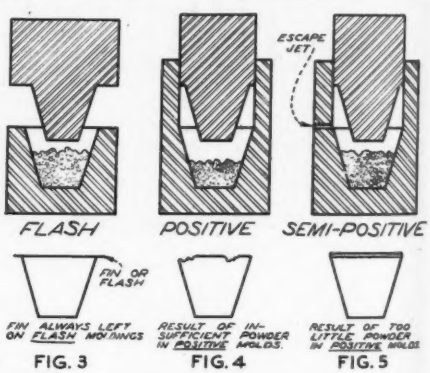

FIG. 3 FIG. 4 FIG. 5

in time, lose their shape. In most cases, low viscosity plastics may be altered by adding suitable plasticizers (hardeners in this case) and fillers so as to increase their viscosity.

A second variety of the compression-type molds is called the positive mold. See Figure 4. These molds produce strong products because they are free from internal strain. In the positive mold, none of the powder is allowed to escape from the mold, and all the available pressure developed by the press is placed upon the molding. This forms the plastic into a compact, well-fused article which possesses little or no internal strains. The exact amount of powder, however, must always be put into the positive mold or the plastic article will not be of the proper dimensions. An insufficient amount of powder may also allow the male die to strike the female die and thus mar the mold surfaces. It is possible to calculate the exact amount

(Continued on page 20A)

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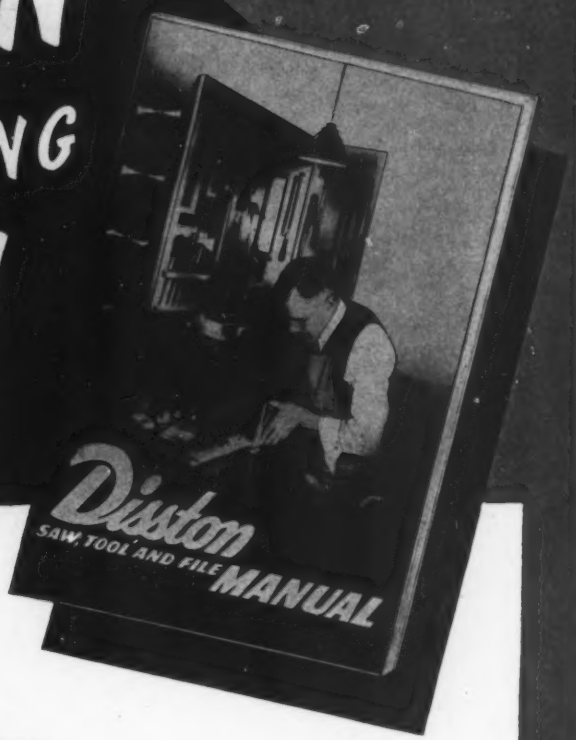

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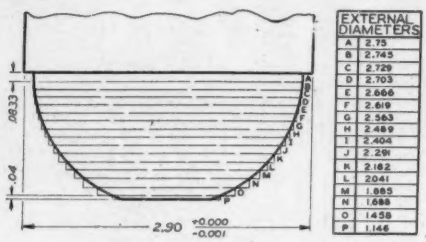
(Continued from page 18A)

of powder necessary to properly charge a molding die. This calculation will be discussed later.

The third and final variety of compression molding dies is so constructed as to allow the excess plastic (if any) to flow out of the mold cavity through a tiny jet. See Figure 5. Thus, it is not necessary to accurately charge the mold with powder each time as long as there is always a very slight overquantity of powder used. The size and location of the escape jet is very important. If the jet is too large, the mold will act like a flash-type mold, allowing the plastic material to escape through the jet so readily as to prevent the full application of available pressure. If the jet is too small the plastic excess will not flow out fast enough. In general, this type of mold is quite good since a certain amount of *flow* within the mold is desirable.

Steel is the ideal material for making molding dies. The porosity of cast iron is somewhat of a handicap in using this metal, but it might be used in a few instances. Brass and bronze could be used, but are probably too soft for continuous operation. It must also be remembered that the molding dies must withstand high pressures without failure.

The mold surfaces must be highly polished and also hardened if the maximum mold life and accuracy is to be secured. If urea and phenolic molding powders are used for molding, it will be necessary to plate the mold surfaces with nickel or chromium. Stainless-steel molds can be used without plating. The precautions just mentioned are necessary because these powders stain ordinary steel molds.



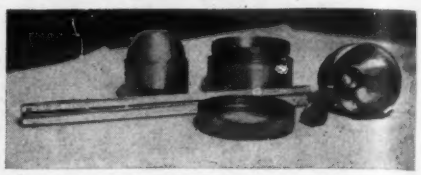


Fig. 6. Male die and hemispherical molding dies assembled

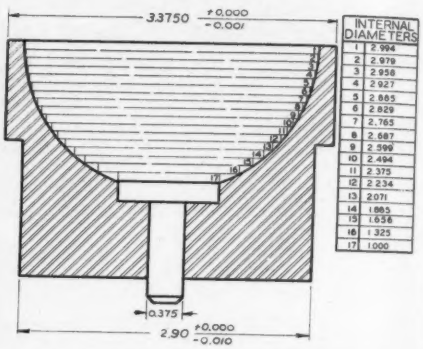


Fig. 7. Female die and knock-out

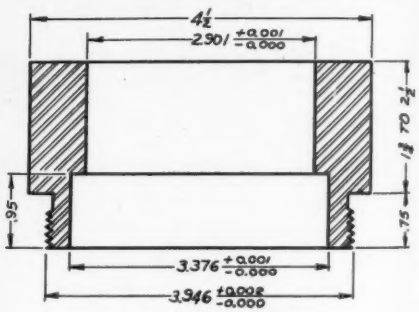


Fig. 8. Guide sleeve

Cold-rolled steel is a good material to use, though it probably will not have the life of harder steels. It was the material used to make the molds shown in this article. It works well on any of the thermoplastics — shellac, methacrylates, styrenes, acetates, and vinyls.

The mold illustrated and dimensioned in Figures 6, 7, 8, and 9, is made of five parts. The two main parts are the male and the female dies, between which (when heated) the molding powder is squeezed or pressed to shape. In order to be sure that the two dies, male and female, always line up properly with each other, a guide cylinder or sleeve is fastened to the female die by means of a threaded clamp ring. It is through this guide cylinder or sleeve that the male die slides to properly match the female die, catching the powder between them and molding it to the shape of the mold cavity. The guide sleeve also acts as a means of preventing the escape of the powder during the exertion of pressure. As such it makes the mold of the positive type

(Continued on page 23A)

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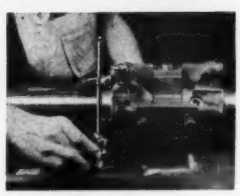

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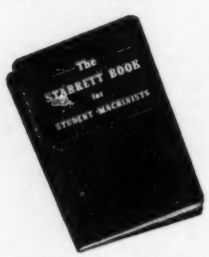

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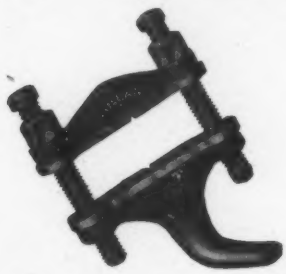

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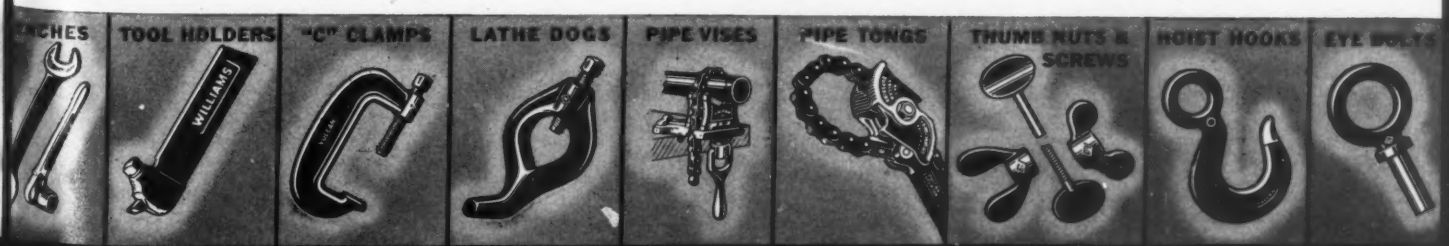

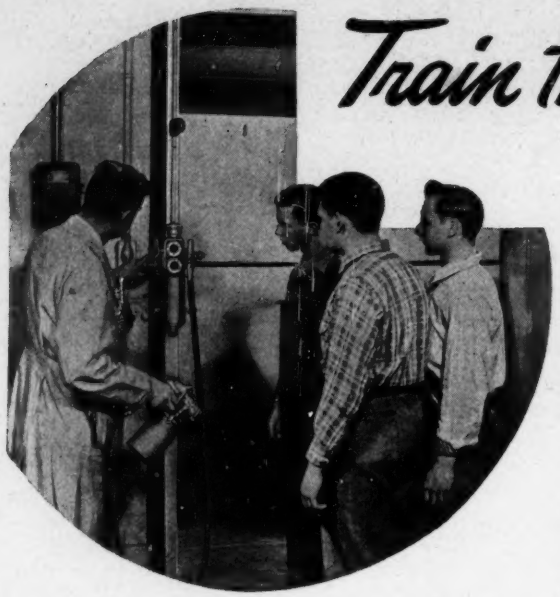

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(Continued from page 20A)

and insures adequate compression of the molding powder.

The knockout pin, shown in Figure 7, is used as its name signifies — to knock out the finished molding from the female die, should it stick there. Should the molding adhere to the male die, it can be removed by inverting the mold and letting the male die fall out through the top of the guide sleeve. The projecting lips of the sleeve will catch the molding while the male die falls free.

The projecting lips on the sleeve also allow the male die to go completely into the female die when there is no powder in the mold.

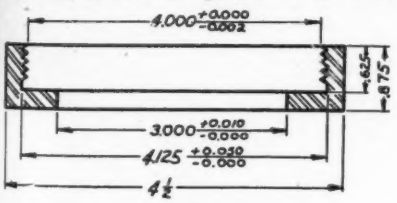

Fig. 9. Clamp ring

Otherwise the two dies would jam each other and stick together at the widest part. If the female die were not larger at the top than the largest part of the male die, and if it were the same diameter as the guide sleeve, the foregoing clearance of parts and the ease of removing the molded plastic article from the male die would not be possible.

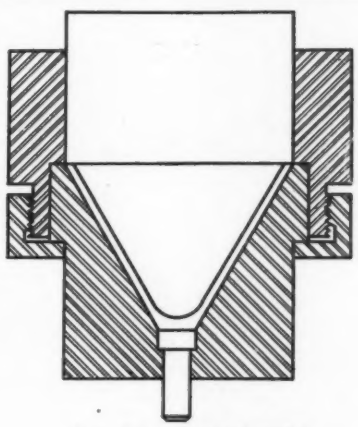

Fig. 10. Conical mold

Plan of Procedure for Making the Hemispherical Molding Dies

1. Select and cut out stock for female die.
2. Mount in universal chuck and turn the 3.375 diameter area at top.

Bill of Material
For Hemispherical Molding Dies

No. required	*Name*	*Material*	*Size*
1	Male die	Cold-rolled steel	3-in. dia. x 3½ in. long
1	Female die	Cold-rolled steel	3½-in. dia. x 2½ in. long
1	Guide sleeve	Steel tubing	4½ o.d. x 2½ i.d. x 2¾ in. to 3½ in.
1	Clamp ring	Steel tubing	4½ o.d. x 2½ i.d. x 1 to 3½ in.
1	Knockout	Cold-rolled steel	1-in. dia. x 1½ in. long

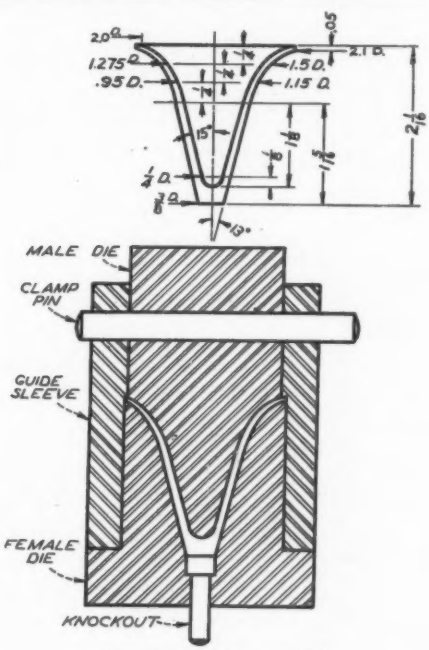

Fig. 11. Flower mold

3. Reverse in chuck and turn the 2.9 diameter area at bottom.
4. Face the bottom of female die.
5. Reverse in chuck and drill to 23/64-in. dia. hole through center.
6. Ream drilled hole to .375-in. diameter.
7. Bore 1-in. diameter hole for head of knockout to proper depth.

(Continued on the following page)

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(Continued from the previous page)

8. Roughly turn out the hemispherical shape of female die.
9. Remove corners of roughly turned hemisphere.
10. Grind and polish inside of female die and remove from chuck.
11. Select and cut out stock for guide sleeve.
12. Face bottom of guide sleeve.
13. Bore inside of sleeve to 2.901 inside diameter.
14. Bore bottom inside of sleeve 3.376 diameter and .95 in. deep.
15. Turn outside of bottom to 4.0 diameter.
16. Cut threads on outside of bottom of guide sleeve 10 threads to the inch.
17. Reverse in chuck and face off top of sleeve.
18. Select and cut out stock for clamp ring.
19. Face off the bottom of the clamp ring.
20. Reverse in chuck and face off top of clamp ring.
21. Bore to 3.0-in. inside diameter.
22. Bore to 3.946 inside diameter .625 deep.
23. Cut threads (10 per inch). Thread is .0271 in. deep.
24. Remove from chuck and mount guide sleeve in it, threads out.
25. Mount clamp ring on sleeve by screwing it on with paper between the shoulder of each. Knurl the outside of the clamp ring.
26. Select stock and cut out male die.
27. Mount in chuck and face off top and center drill.
28. Mount in chuck, face off bottom and center drill.
29. Mount between centers and turn to outside diameter to fit into sleeve. This fit can be fairly loose, but the tighter the better, if binding does not occur.
30. Mount male die in universal chuck and rough turn the hemispherical shape. Also reface the bottom to remove center drill mark.
31. Turn off the corners left by rough turning.
32. File and polish mold surface.
33. Select and cut out stock for knockout.
34. Mount in chuck and face off bottom.
35. Turn to .374-in. diameter, leaving extra thickness for head.
36. Reverse in chuck and face off top of knockout to exact thickness.
37. Polish face of knockout.

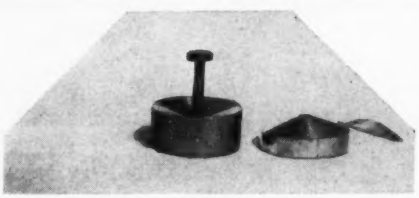

Fig. 12. Drawing dies with drawn plastic base for a goblet

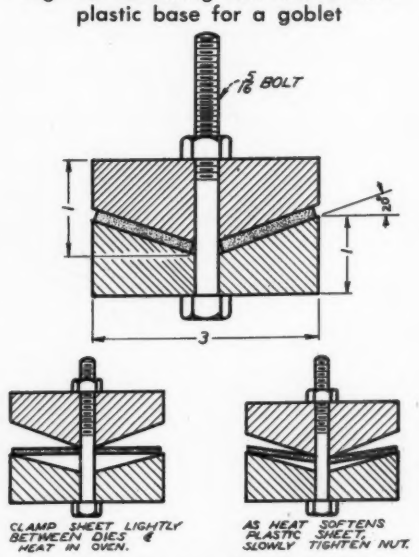

Fig. 13. Drawing dies for plastic sheet

Figures 10 and 11 show several different molding dies in cross section. The dies for making the conical shaped mold, shown in Figure 10, are similar in construction to the hemispherical dies just described. Such a mold would make a suitable top for a goblet or sherbet glass. The top diameter is 3 in., and the included angle between the sides is 60 deg. The knockout punch is ⅜ in. in diameter at the top.

The flower-shaped mold, shown in Figure 11, presents a new way of clamping the guide sleeve. Here it is clamped to the male die rather than to the female die. Such an arrangement allows the usage of a pin to hold the two parts together. This pin is easier to remove, by simply knocking it out, than is the clamp-ring style. Thus it is easier to open molds of this type. The pin is made of hardened steel and the hole into which it slides is reamed. This arrangement of fastening the mold together could be used on the hemispheri-

(Continued on page 26A)

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(Continued from page 24A)

cal dies by lengthening the part of the guide sleeve into which the female die fits.

Another type of die, a drawing die, is shown in Figures 12 and 13. It is used for pressing or drawing a sheet of plastic to the shape of a shallow cone. The steps in its manipulation are shown. This type of mold was used to produce the base of the goblet shown in Figure 11 on page 294 of the September, 1942, issue of this magazine.

Analysis, course of study, instructional unit, and lesson — these are four important terms. . . . We should think of them in the order shown rather than in the reverse or any other sequence.

— Homer J. Smith

Personal News

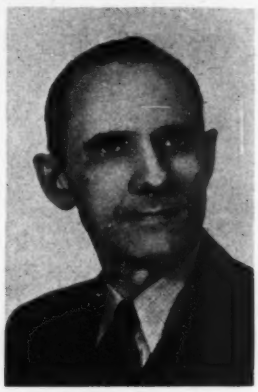
LINDER S. WOOD RETIRES

Linder S. Wood, until recently head of the industrial-arts department of the high school at Bloomington, Ill., has retired after 35 years of teaching experience.

Mr. Wood was born at Mt. Carmel, Ill., May 5, 1885. He attended the elementary and high schools at his native city, and received a bachelor's degree from Valparaiso University. He also did some graduate work at Bradley Polytechnic Institute, Peoria, Ill., and at the University of Wisconsin, Madison, Wis.

He taught rural and village schools for 5 years in Wabash County, Ill.; industrial arts for 2 years in the grade schools at Las Animas, Colo.; and 4 years in the high school at Mt. Carmel, Ill. After this he spent 24 years as head of the industrial-arts department, and teacher of drafting in the high school at Bloomington, Ill.

He has been draftsman for various firms, and is at present engaged in the drafting room at the Link-Belt Co., Chicago, Ill.



Linder S. Wood

Mr. Wood has been secretary of the Illinois Manual Arts Association; chairman of the industrial-arts section of the Illinois Industrial Education Association; and served as a member of the Illinois High School Conference committee which prepared a brochure entitled "Syllabus of Mechanical Drawing Courses for Illinois High Schools."

He has also written for the professional magazines in the fields of industrial arts and vocational education, and has appeared on various programs of the professional societies to which he belonged.

APPOINTED CHAIRMAN OF INDUSTRIAL-ARTS DEPARTMENT

Victor L. Bowers has been appointed chairman of the industrial-arts department of the Southwest Texas State Teachers College, San Marcos, Tex.

Victor L. Bowers

Mr. Bowers received the B.A. degree in industrial arts at the East Texas State Teachers College, Commerce, Tex., in 1932.

The M.A. degree in industrial arts was conferred on him by The Ohio State University, Columbus, Ohio, in 1937, and the degree of Ph.D., also by The Ohio State University in 1941.

His teaching experience covers six years industrial-arts teaching in Texas high schools, including two years as principal; one year as acting assistant professor of industrial arts, Miami University, Oxford, Ohio; two years as assistant,

(Continued on page 31A)

Filing Hints to meet war-time needs

HELLER NUCUT

FILE-FINDER CHART

TO THE SHOP-WORKER—particularly the beginner who is often confused by the innumerable types, shapes and cuts of files available—the accompanying chart is offered as a helpful guide in distinguishing between one file and another.

FILES CLASSIFIED BY	PRINCIPAL KINDS UNDER EACH CLASSIFICATION
Service	Machinist Files: For general machine shop work Mill Files: For sharpening saws and for finishing Swiss Pattern Files: For delicate filing with high precision Rasps: For wood and similar soft materials
Length	Length is distance from the shoulder (or place where tang begins) to the point. Lengths in general use range from 4" to 18".
Shape (Cross-Section)	(1) Flat (2) Hand (3) Pillar (4) Warding (5) Square (6) Three-Square (Triangular) (7) Round (8) Half-Round (9) Knife (10) Mill (11) Taper (12) Slim Taper (13) Extra Slim Taper (14) Double Extra Slim Taper (15) Cant Saw (16) Cross-Cut (17) Pit Saw (18) Flat Rasp (19) Half Round Rasp (20) Cabinet Rasp, etc.
Spacing of Teeth	(1) Bastard (2) Second Cut (3) Smooth
Character of Teeth	Single Cut; Double Cut; Rasp Cut
Width (Face) and Thickness (Edge)	Uniform (square) throughout length; tapered; or both
Material to File	Iron, Steel, Stainless Steel, Alloy Steel, Aluminum, Copper, Brass, Lead, Fibre, Leather, Plastic, Slate, Wood, Etc.

"MORE CUTS WITH NUCUTS"—The moment you use a NUCUT, you know that it does more work faster, easier, better. That is so because of the exclusive "Wavy Teeth" design—a patented scientific combination of coarse and fine teeth that cut deep, clear and finish smooth—all at the same stroke!

HELLER BROTHERS COMPANY • Newark, N. J. • Newcomerstown, Ohio

America's Oldest File Manufacturers — Good Tools Since 1836

HELLER NUCUT WAVY TEETH FILES

PATENT No. 2027039

Logically so. Draftsmen swear by them because they hold their points; wear slowly. With teachers, as with business men, the fact they do not crumble in a pencil sharpener is a notable advantage. Everyone welcomes their exceptional brilliance of color. The student who is taught color-code, section lines, and structural details will owe a vote of thanks to the instructor who introduces him to MONGOL Colored Pencils. Can be used also for color-work effects . . . At all supply stores, in 24 colors.

MONGOL
THIN-LEAD
COLORED PENCILS

For wash-drawings, too!

EBERHARD FABER

Makers of the famous MICROTOMIC VAN DYKE Drawing Pencil

SPEED UP
Defense Training
with **VICTORAY** *Prints*

Students progress faster by getting practical experience reading blue prints or black and white prints for dimensions needed on machine operations.

ONLY 4 MINUTES
AFTER TRACINGS ARE FINISHED
PERFECT BLUE PRINTS
OR BLACK AND WHITE PRINTS ARE AVAILABLE

WITH VICTORAY YOUR COST OF PRINTS WILL BE
APPROXIMATELY 1c PER SQUARE FOOT

Safety **VICTORAY** *Simplicity*

No Motor — Silent Operation — No Odor. Makes perfect prints in day light. Can be operated safely by any novice. Portable — Takes little space.

Prints 24" x 36" or several smaller sheets in one operation in 3 minutes.

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Minimum Life of Lamps 1200 Hours.
Give 1200 hours of printing service.
Lamps obtainable at
20c each everywhere.
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150 W. Lamps **$1.60**

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VICTORAY CORPORATION
GENERAL OFFICES AND PLANT
BATTLE CREEK • MICHIGAN

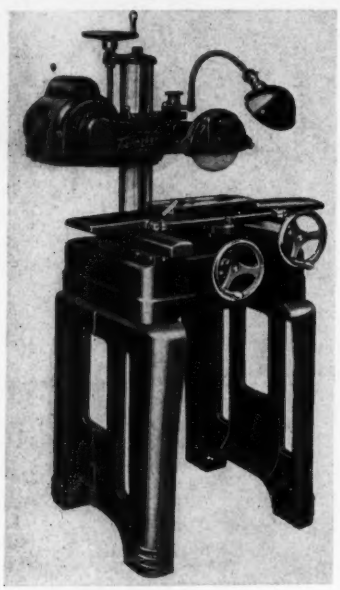
Shop Equipment News

New Products — Publications

A NEW SURFACE GRINDER

A new type surface grinder has just been announced by the Delta Manufacturing Co., Milwaukee, Wis. This new grinder has a wheel-mounting arrangement that utilizes a two-piece adapter, so that either wheel, or wheel and adapter can be removed.

The spindle is equipped with widely spaced bearings at either end to provide permanent true alignment. The forward bearing is a large surface taper bronze bearing which runs in a continuous bath of oil. A take-up is provided to eliminate all play. The rear bearing is a sealed-for-life bearing that requires no lubrication.



Delta surface grinder

The table has long ways so that it never "hangs" over the end of the machine, but is always riding solidly on the ways. Gibs are provided so that all play due to wear can be eliminated. A micrometer collar, with wide graduations on the traverse adjustment, permits accurate settings.

The column is cast of hitensile iron, normalized and accurately ground to close tolerances. A steel gib guides the bracket yoke so that it is always in perfect alignment. The entire column, together with the bracket, may be rotated 360 deg.

The maximum length that can be ground on this grinder is 13½ in.; maximum width is 6 in.; maximum space under 7-in. wheel to table, 9½ in.; and to B & S No. 510 Magnetic Chuck, 6 in. The table surface is 5¾ by 13 in. Each graduation on the traverse feed is .001 in. The maximum adjustment of wheel by means of micrometer is ⅜ in., and each graduation is .0005 in. Minimum diameter cup wheel with standard guard in place, 3½ in., maximum diameter wheel, 7 in.

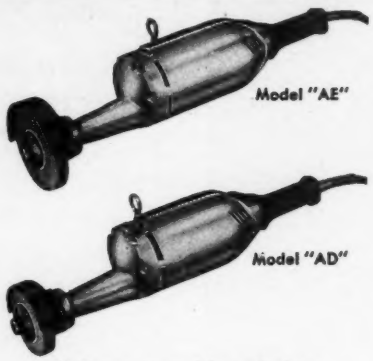
Delta Manufacturing Co., Milwaukee, Wis.

For brief reference use IAVE—1110.

TWO NEW PORTABLE GRINDERS

Model AD, 4-in., and Model AE, 5-in. portable grinders have just been added to the line of electric tools manufactured by Skilsaw, Inc., Chicago, Ill.

Both of these models are equipped with ball bearings mounted in steel inserts on armature and



Skilsaw portable grinders

extreme ends of wheel spindle to absorb the thrust, eliminate vibration, and insure cool operation. Commutator and switch are fully enclosed for protection against dust, and straight-line ventilation blows dirt away from the operator. A universal motor assures full efficiency under load. A rubber sleeve handle provides a firm, cool, nonslip grip.

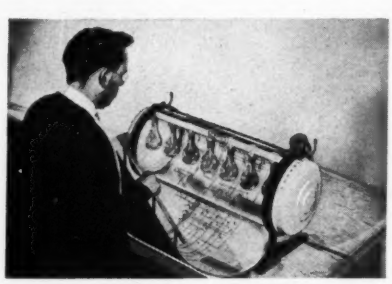
Model AD is 22 in. long, and weighs 15 lbs. It operates at no-load speed of 4500 r.p.m., driving a grinding wheel 4 in. by ¾ by ½ in. Model AE has a grinding wheel 5 by ¾ by ½ in. and operates at 4200 r.p.m. It weighs 18 lb. and is 22⅝ in. long.

Skilsaw, Inc., Chicago, Ill.

For brief reference use IAVE—1111.

SPEEDING UP BLUEPRINT PRODUCTION

The Victoray machine makes blueprints or black and white prints in four minutes. This machine will make 24 by 34-in. prints, or several smaller prints in one operation. There is no need for a motor, for gears, and for lubrication; hence, there is nothing to get out of order.



The machine performs its services noiselessly and can be used right in the drafting room and in daylight. It takes up but little room — 15 by 21 by 36 in. — and weighs but 60 lb. The cost of lamp replacement also is very low.

For further information, address Victoray Corp., Battle Creek, Mich.

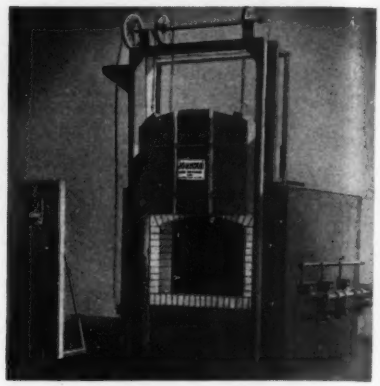
For brief reference use IAVE—1112.

AN INTERESTING ENGINEERING FEAT

The specially built Johnson unit, illustrated herewith, has inside combustion chamber measurements of 36 in. wide, 30 in. high, and 60 in. long. The furnace is lined with 5½-in. insulation and faced with 4½-in. insulating refractory.

Among the unusual features of this furnace are the electrically operated door which raises in 5 seconds and stops automatically; proportioning-type control which automatically regulates furnace temperature and stack damper position; and push-button electric ignition that lights burners with complete safety.

It was specially built for one of the nation's busiest war plants, and it took but 49 days from



Johnson heat-treating furnace

the time the problem was submitted to the time of starting the furnace on its operating cycle in the plant.

All standard Johnson units can now be delivered in two weeks, on orders carrying A1-J priority rating or better. Free catalogs showing all standard Johnson Gas Appliances will be sent to those requesting it from the Johnson Gas Appliance Co., Cedar Rapids, Iowa.

For brief reference use IAVE—1113.

"ELECTRICAL LABORATORY SPECIFICATIONS"

Specification Data 190 is a 37-page booklet, announced by the Westinghouse Electric and Mfg. Co. It was written to help instructors planning new plants or expanding present facilities.

The booklet also contains a layout of a miniature laboratory. The various pieces of laboratory equipment are shown in plan outline, accurately drawn to the scale of ¼ in. to the foot. The drawings are imprinted on heavy, perforated pages so that the page can be readily torn from the book. The pieces of equipment can be cut out separately and placed on a plan of the laboratory drawn to the same scale. This makes it possible to arrange the apparatus in various ways so that the final setup will be convenient for current supply, belt connections, and effective instruction.

The catalog also lists the minimum equipment required to set up a laboratory, complete with indication of cost, together with similar lists for larger installations.

Address Dept. 7–N–20, Westinghouse Electric and Mfg. Co., East Pittsburgh, Pa.

For brief reference use IAVE—1114.

USEFUL LATHE BOOKLETS

South Bend Lathe Works, Dept. K7, South Bend, Ind., has just issued a catalog and two bulletins which will interest machine-shop teachers.

The new catalog describes all the toolroom lathes, quick-change gear lathes, plain change-gear lathes, turret lathes, and lathe attachments manufactured by the firm. Besides giving precise descriptions of all of the machines mentioned, the catalog also contains a page of profile outlines of the various lathes together with tables of dimensions so that scale layouts may be made.

Bulletin 1004 describes the new bench model turret lathes 1003-C and 1004-C. Convenient tabulated specifications give the necessary information on capacities, feeds, speeds, and dimensions.

Bulletin H-1 is a 16-page pamphlet devoted to instructional material on how to "keep your lathe clean."

For brief reference use IAVE—1115.

Narrow the Gap Between Training and Production for Your Students

TOOL STEEL SIMPLIFIED

By Frank R. Palmer Vice-President of the Carpenter Steel Company, Reading, Pa.

This complete, up-to-date text shows the beginning students the right way

- to select tool steel
- to make tools
- to avoid trouble
- to improve tool performance

In short, TOOL STEEL SIMPLIFIED *trains the student in the shortest possible time to be a skilled tool and die maker.*

The economical price of $1.00 per copy makes it practical to use this book in your classes in large quantities. Every student can afford to have one for his own use in present training and will want to keep it for permanent use in future trade work.

315 pages — 205 illustrations — $1.00 postpaid in U.S.A. ($3.50 elsewhere)

Vocational and trade teachers recommend TOOL STEEL SIMPLIFIED: "Consider it one of the very finest books that our local schools of vocational and adult education might use in training of apprentices in machine trades." — R. L. Welch, Supervisor of Industrial Education, State of Wisconsin.

"Simple and easy to read. Contains useful information which commends it to technical men, semi-technical men in the shops who want to improve their ability to make the best use of tools." — Prof. Bradley Stoughton, Dept. of Metallurgical Engineering, Lehigh University.

". . . have read and reread the book. Became absorbed in finding out and learning so many things I never knew before. Chapter 17 on quenching is worth the price of the book." — F. E. Laverty, Worcester Boys' Trade School, Worcester, Mass.

Elementary enough to be used in training beginners, it contains hundreds of practical suggestions that the worker can apply in his daily life to assure improved tool performance. All the material is highly teachable since it is presented in such an interesting way, the student will be attracted to it and will welcome the helpful information it gives him.

Hundreds of vocational and trade teachers use this text not only because it meets the demand for training the student of tool and die making to take his place in industry, but also because it is useful as a guide to his daily work when he is actually engaged in the trade.

Instructors of schools may order a copy of this text for thirty days' study from

THE CARPENTER STEEL COMPANY

Dept. 14G Reading, Pa.

(Continued from page 26A)

industrial-arts education, The Ohio State University, Columbus; two summer terms as visiting lecturer in industrial arts, Ohio University, Athens, Ohio; and one year as instructor in industrial arts, Northern Illinois State Teachers College, DeKalb, Ill.

F. N. NEWTON, JR., APPOINTED SUPERVISOR OF INDUSTRIAL EDUCATION

F. N. Newton, Jr., formerly mechanical-drawing instructor at Sharon High School, was elected supervisor of industrial education of the public school system at Sharon, Pa. One of his first

F. N. Newton, Jr.

duties will be to develop an industrial-arts program at the junior high school for the seventh, eighth, and ninth grades.

During the coming term the seventh-grade students will get drawing and woodworking, and the eighth-grade pupils will get an introductory course in general shopwork. Next year the seventh grade will get a revised woodworking course and the eighth grade a fuller general shop course.

Besides his new duties Mr. Newton is the commander of his legion post and teaches engineering drawing and descriptive geometry in the night defense program.

♦ HEBER A. SOTZIN has resigned the directorship of industrial arts of the Philadelphia public schools, and has returned to his former field of action, San Jose, Calif.

♦ GLEN D. BROWN, professor and head of industrial education and director of the Baltimore division, College of Education, University of Maryland, who has been on leave since June 16, 1941, as state youth administrator, N.Y.A., for Maryland and the District of Columbia, and more recently has acted as assistant regional Administrator, N.Y.A., Region IV, returned to his regular University of Maryland assignment on August 1, 1942.

In addition, Professor Brown has assumed, on a part-time basis, the position of acting supervisor of trade and industrial education with the Maryland state department of education. His high interest and experience in industrial arts and vocational-industrial education will be utilized in the redirection of these fields toward functional activities in the war effort or victory program, and basic planning for postwar needs.

♦ HOWARD PYLE, formerly general shop instructor at Somerset High School, has been appointed instructor of the new general shop course inaugurated at the Junior High School, Sharon, Pa.

♦ E. G. LIVINGSTON has resigned as chairman of the fine and practical arts department, Georgia Teachers College, Collegeboro, Ga., and is now employed by the Bell Aircraft Corp., Buffalo, N. Y. He will later be transferred to their new plant at Marietta, Ga.

♦ ALFRED L. THIEDE, State Teachers College, Mankato, Minn., has been commissioned a lieutenant in the navy, and will leave soon for a naval air training base.

♦ RAY CRAIL has succeeded C. W. Popkins at High School East in Wichita. In his new position he will assist J. C. Woodin in the supervision of the day trade program. He was formerly instructor of the related subjects in the electrical trade course, high school radio courses, and evening radio theory classes. During the past summer Mr. Crail was employed in the radio department of one of the Wichita aircraft factories.

♦ H. S. COY, former shop foreman at a Topeka electrical establishment, is now instructor of the electrical trades course just started at Topeka. This course is the third to be started in the Topeka schools since the starting of school a year ago.

♦ ALLEN R. PAWELEK, formerly on the faculty of Denby High School, Detroit, Mich., has been appointed to teach airplane electricity at the Ford Airplane School, Willow Run Bomber Plant.

♦ DANA P. VAUGHAN, dean of Rhode Island School of Design for the past nine years, has resigned that position to become director of the School of Industrial Arts at Trenton, N. J. He took over his new position September 16, succeeding the late Frank Forrest Frederick, who was head of the school for 36 years.

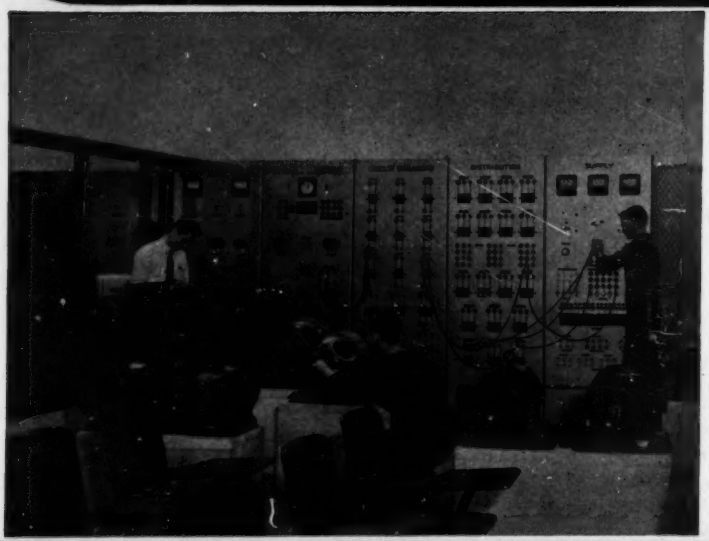
♦ KENNETH W. MCFARLAND has been appointed superintendent of the public schools at Topeka, Kans. While at Coffeyville, Kans., Supt. McFarland was instrumental in building a trade school and developing a vocational-education program.

♦ ROLAND A. COX, supervisor of printing, College of the Ozarks, Clarksville, Ark., has accepted the position as supervisor of printing in Salina, Kans., schools, starting in September.

♦ ROY N. WALTERS announces his appointment as acting dean of the Berea College Foundation

(Continued on following page)

Equip for MAXIMUM Effectiveness
IN SHOP AND LABORATORY TRAINING



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● **In these times when fast, effective technical training is so imperative, Standard Panels fulfill an important function in the laboratory and shop on electrical instruction. Exceptionally versatile in applications, Standard Panels provide maximum circuit and operating flexibility — speed in connection changes. Standard Panels are modernly designed, sturdy, low in cost. Offered in several models for all branches of electrical instruction, elementary and advanced. Our experienced field engineers will bring you complete data.**

"Standard Makes Every Minute Count"

THE STANDARD ELECTRIC TIME COMPANY
79 LOGAN ST., SPRINGFIELD, MASS. BRANCH OFFICES IN PRINCIPAL CITIES

(Continued from previous page)

School at Berea, Ky. He will continue to teach a class or two in printing.

♦ ROY O. LARSON, formerly teacher of printing at West High School, Green Bay, Wis., is preparing himself to become an instructor in the United States Army Signal Corps.

♦ KENNETH L. ELLIOTT, former printing instructor at the Senior High School, Little Rock, Ark., is now at the Arkansas Ordnance Plant at Little Rock. He edits the AOP *News*, official ordnance plant publication.

♦ ARTHUR O. LILLEGRAVEN, former managing editor of the *Madison Lake* (Minn.) *Times*, will be head of the department of printing and publishing of the city public schools of Menominee, Mich.

♦ LEONARD A. STOLFO, granted a leave of absence as printing instructor of Fordson High School at Dearborn, Mich., is now in the Ordnance Service and Supplies branch of the United States Army at Aberdeen, Md.

Association News

A.V.A. CONVENTION AT TOLEDO

Planned as a direct aid to promotion of the war effort, the annual convention of the American Vocational Association will be held in Toledo, Ohio, December 2 to 5, 1942. Man power, preinduction training, high school victory corps, and other war needs will be stressed by representatives of the armed forces, the Federal Government, war industries, and the schools.

The various A.V.A. general and sectional meetings — industrial education and industrial arts, home economics, agriculture and business education, guidance and rehabilitation, part-time and full-time vocational education — will give first consideration to increased training of war-production workers or the production, distribution, and use of food in the war emergency.

The Toledo convention promises to be the most important in the history of the Association. While the training of 2,500,000 war-production workers this year in vocational schools under the federal program is now being taken in stride, new demands have already been made, and more will come in the future, all bringing new challenges to vocational education.

Discussions and contacts at the A.V.A. meetings in Toledo will give school executives and vocational and industrial-arts teachers and supervisors opportunity to plan local programs of action that will tend immediately to speed up the war effort on the educational front.

The industrial-arts sectional meetings, according to Vice-President Arthur B. Mays will be very much worth while. Dr. Lawrence F. Ashley, of Yonkers, N. Y., will be chairman of the Thursday morning meeting, the theme of the meeting being "Success Factors in the Growth and Achievement of the Teacher of Industrial Arts." Thursday afternoon the chairman will be Dr. Thomas A. Hippaka, of Iowa State College, and the theme of the program will be "Problems and Procedures of Industrial Arts in the Small School." On Friday morning Mr. George H. Hargitt, director of Industrial Arts of St. Louis, Mo., will be the chairman, and the general theme will be "Industrial Arts in the Postwar Era." Saturday morning the program will be on "Significant Trends and Relationships of Industrial Arts," and the chairman will be Dr. William T. Bawden. The annual Saturday luncheon, which for so many years has been a feature of the industrial-arts program, is being developed by Professor Thomas Diamond of the University of Michigan, with Mr. Frank Moore of Cleveland cooperating. All of the chairmen have practically completed their programs, and they have been very fortunate in securing outstanding speakers for every program.

George H. Fern, state director of vocational education in Michigan, is preparing the trade and industrial education programs.

The following groups will hold their meetings in conjunction with the A.V.A.:

National Association of State Directors of Vocational Education, on December 2 and 3;

National Council of City Administrators of Vocational Education and Industrial Arts, on December 2;

National Association of State Supervisors of Trade and Industrial Education, on December 2;

National Association of Trade and Industrial Teacher-Trainers, on December 2; and

National Association of Trade School Principals, on December 2.

News Notes

♦ Appealing to photographers and camera enthusiasts to help record the wartime work of the American Red Cross both at home and abroad, Chairman Norman H. Davis has announced a national photographic competition with 122 prizes consisting of war savings bonds with a total maturity value of $5,125. The competition will continue through October, November, and December, and two classes of awards will be made: for the best photographs submitted each month 36 prizes will be awarded, to be followed with 14 grand prizes to selections from among the monthly prize-winning entries.

The American Red Cross needs the imagination of camera enthusiasts to capture the drama, the pathos, the sympathy, and the mercy embodied in its work.

Entrants may submit as many pictures as desired at any time during the contest, but no photographs which heretofore have been published are eligible. All entries must portray an

(Continued on page 34A)

FOR INSTRUCTION, TOO... *Industry's Test Instruments* COST LESS . . . BECAUSE OF THEIR LONG-LIFE DEPENDABILITY!

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Sensitive and Power Uses
Current and Voltage Types

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Tubecheckers, Analyzers, Oscillators, Ohmmeters, Vacuum Tube Voltmeters

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Power Analyzer, Photoelectric Potentiometer, Battery Testing Instruments

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Ammeters, Voltmeters, Wattmeters, Galvanometers, Microammeters, Ohmmeters, Microfarad Meters

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Portable and Switchboard — Potential and Current

PORTABLE INDICATING INSTRUMENTS
Ammeters, Voltmeters, Wattmeters, Galvanometers, Microammeters, Ohmmeters, Microfarad Meters

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Voltmeters, Ammeters, Wattmeters

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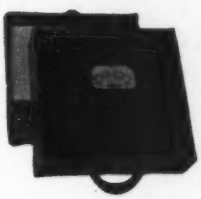
WESTON *MODEL 430*

A-C AND D-C INSTRUMENTS

Ideally suited for classroom instruction and student use because of their dependability, ruggedness and relatively low cost . . . features which have made the Model 430 line so universally preferred throughout industry. Have hand-calibrated mirror scales of long length, with large scale openings. Accuracy within ½ of 1%. Sturdy Bakelite cases give added protection in service. Extremely compact. Available in complete line of A-C and D-C instruments.

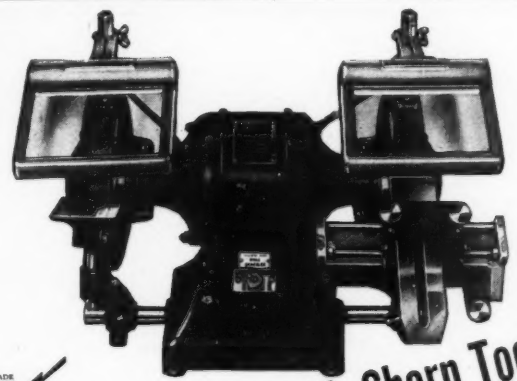
WESTON *MODEL 785*



INDUSTRIAL CIRCUIT TESTER

A complete circuit tester for shop or laboratory. Has 27 voltage, current and resistance ranges (d-c voltage sensitivity 20,000 ohms per volt), for checking motor and control circuits, lighting circuits, sensitive relay circuits, communication circuits, etc., etc. Also available with compact resistance tester for checking insulation and cable covering resistance values up to 900 megohms.

WESTON ELECTRICAL INSTRUMENT CORPORATION, 595 Frelinghuysen Avenue, Newark, N. J.



TRADE STANLEY MARK

Start every project with Sharp Tools

THE STANLEY No. 677 GRINDER

is a safe edge tool grinder, especially designed for school shops. It eliminates practically all of the burning tendencies and makes it easy to teach boys the proper grinding of Plane Irons and Chisels. Equipped with "Flud-Lite" Eye Shields. Write for complete specifications.

FEATURES THAT ASSURE EXTRA VALUE

1725 R.P.M.
Heavy Duty Fully Enclosed Motor
Dust Sealed Ball Bearings
Guarded Wheels
Plane Iron and Chisel Grinding Fixture
"FLUD-LITE" Safety Eye Shields

STANLEY ELECTRIC TOOLS

EDUCATIONAL DEPARTMENT, STANLEY ELECTRIC TOOL DIVISION
THE STANLEY WORKS, NEW BRITAIN, CONN.

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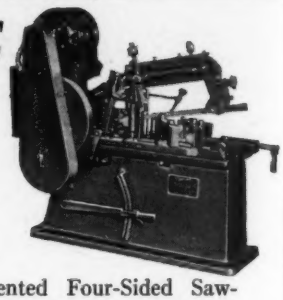

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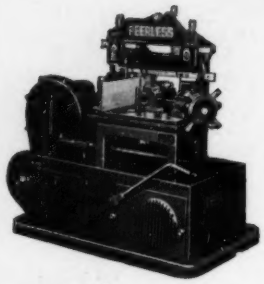

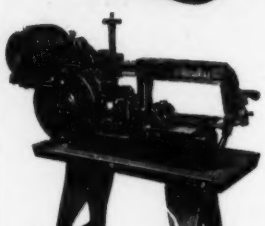

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FAST, ACCURATE CUTTING DEMANDS POSITIVE BLADE CONTROL

(Continued from page 32A)

activity of the American Red Cross or be symbolic of the spirit of the American Red Cross. Red Cross chapters the country over are prepared to assist photographers in the selection of subjects.

The competition will be known as the "Red Cross National Photo Awards." Headquarters are at 598 Madison Avenue, New York City, and all entries must be sent to that address.

♦ With production hitting a faster pace than ever before, the Maritime Commission is calling for many expediters to break bottlenecks and see that schedules are met in factories producing marine propelling or outfitting equipment.

The U. S. Civil Service Commission is recruiting expediters for positions paying $2,600 to $3,800. For positions paying $3,200 to $3,800, men are desired who have had experience in a factory engaged in the manufacture of heavy or moderately heavy machinery in positions at or above the grade of factory or shop foreman and in addition, experience as a factory representative, sales manager, sales engineer, or direct distributor for the factory. For the $2,600 positions, experience in machinery factories as machinist or patternmaker or in other positions requiring a working knowledge of machine-shop practice, is qualifying.

There are no age limits for this examination. No written tests are required.

Announcements and application forms may be obtained at any first- or second-class post office or from the Civil Service Commission, Washington, D. C.

♦ Over 2000 reels of the film, "The Inside of Arc Welding," put out by the General Electric Co., Schenectady, N. Y., are in regular use throughout the United States alone, while numerous reels are being used in England, Canada, Brazil, and South Africa. Of these, 30 complete sets are being used by the United States Navy in its training programs, and 25 sets by the War Department. Hundreds of prints of this film are in use by state vocational departments, private welding schools, shipyards, and other industrial manufacturers.

Made in full color and sound, six reels in length (although each reel can be shown independently), and available at print cost, "The Inside of Arc Welding" presents clearly, completely, and entertainingly all the basic fundamentals of modern arc-welding technique. Beginners, as well as experts, profit from the film since it bridges the many hard-to-understand gaps between the written and the spoken word.

♦ A release from the State News Bureau, Raleigh, N. C., reports that North Carolina's 800 women school-bus drivers, most of whom are high school girls of 16 to 18 years, have demonstrated that they require 40 per cent less money for repairs and 20 per cent less fuel than do men or boy drivers on identical routes.

What is more, the girls have not been involved in a single serious accident, they lead the boys in efficient driving, meet their schedules on time, and take care of their buses better than the boys do.

♦ The Y.M.C.A. Motion Picture Bureau, 347 Madison Ave., New York City; 19 So. LaSalle St., Chicago, Ill.; 1700 Patterson Ave., Dallas, Tex.; and 351 Turk St., San Francisco, Calif., have just issued their classified film lists of 16mm. films (most of them sound and some in technicolor), for use in fine- and industrial-arts classes, science classes, sports and athletics, transportation and communications, vocations, etc.

♦ A list of 26 job opportunities in the United States Army Air Forces, for which young men can prepare prior to induction, is herewith given:

Enlisted men — ground technicians: aircraft armorers, aircraft machinists, aircraft metal-workers, aircraft welders, aircraft mechanics, teletype repairmen, link trainer instructors, parachute riggers, photographers, radio operators and mechanics, weather observers, administrative clerks, and supply and technical clerks.

Enlisted men — flying: glider pilots, staff sergeant pilots, aerial engineers, radio operators, aerial gunners.

Aviation cadets (officers — flying): bombardier, navigator, pilot. (Officers — ground): armament officer, communication officer, engineering officer, meteorology officer, and photography officer.

♦ War Training Models Unit W.P.A, 100 N. Cameron St., Harrisburg, Pa., announces the following teaching aids for schools teaching courses in aeronautics.

Classroom model — U. S. Army Piper O–59 airplane built to 1/5 actual size. It has a skinless steel fuselage and tail assembly. Control systems, ailerons, elevators, and the like, respond instantly to manipulations of stick. Plane is mounted on rolling tripod in such a manner that it can be tilted 180 deg. forward or sideways.

Delivery in six to eight weeks from date of order.

Classroom model of radial gasoline-type aircraft engine. Three-fourths actual size, section of 5-cylinder engine. Pistons and connecting rods operate as in regular engine, firing in the order of cylinders 1, 3, 5, 2, 4. Bulb at each cylinder head flashes at instant of firing.

Model is operated by hand crank. Delivery in approximately two months.

Model airplane for classroom instruction in handling of controls and teaching of flight maneuvers. Wing spread 18 in. Very exaggerated control stick, rudder pedals, ailerons, elevators, and rudder. Model expressly designed for classroom instruction where instructor and each student is supplied with a model. Sold in lots of five. Delivery in one to four weeks.

Sextant. Double actual size wooden demonstration model. Complete with sun filters and felt-lined plywood case. Delivery in six to eight weeks.

(Continued on page 37A)

(Continued from page 34A)

Blackboard globe. Hollow sphere 24 in. in diameter, mounted on stand and equipped with built-in protractors. Surface finished smooth to enable navigational problems to be drawn on it in chalk. Delivery in four to six weeks.

An 8-ft. slide rule made from a single sheet of Bakelite resin for the engineering war training program at the University of Pennsylvania. The rule is mounted on a head-high rolling stand and is pushed from room to room to serve various classes. Students can read the rule at 30 ft. distance without eye strain.

New Publications

Air-Age Education Series

Published by the Macmillan Co., New York City. This series consists of the following books:

Science of Pre-Flight Aeronautics for High Schools. Prepared by the Aviation Education Research Group of Teachers College, Columbia University. Cloth, 868 pages, 5¾ by 8⅝ in., illustrated. Price, $1.32.

This consists of seven books. Book I treats of the principles of airplane structures; Book II covers the human factors in flight; Book III describes how to keep the plane aloft; Book IV explains the aircraft engine; Book V discusses meteorology; Book VI gives the details of communication and Book VII is on air navigation.

Elements of Pre-Flight Aeronautics for High Schools. Prepared by the Aviation Education Research Group of Teachers College, University of Nebraska. Cloth, 556 pages, 5¾ by 8⅝ in., illustrated. Price, 96 cents.

This book consists of eight units which cover flying, the ocean of air, why an airplane flies, the power required to fly, aircraft communications, flying to a given destination, how aeronautical workers are prepared for their jobs, and living in the air age.

Human Geography in the Air Age. By George T. Renner. Cloth, 238 pages, 5¾ by 8⅝ in., illustrated. Price, 64 cents.

The nine chapters of this book are devoted to developing and understanding the earth's geography in relation to economics, and to political and national thought.

Physical Science in the Air Age. By J. G. Manzer, M. M. Peake, and J. M. Leps. Cloth, 198 pages, 5¾ by 8⅝ in., illustrated. Price, 80 cents.

This is a teacher's guide which covers the subjects of aircrafts, airfoils, the forces acting upon the airplane, the propeller and the controls, engines, materials used, fuels, navigation, meteorology, the radio, and uses of the airplane.

Social Studies for the Air Age. By Hall Bartlett. Cloth, 169 pages, 5¾ by 8⅝ in., illustrated. Price, 60 cents.

In this book man's effort to dominate the air is discussed; also the world war of the air, and aviation in peacetimes, as well as the future of flight, and the administrative control and legal aspects of aviation.

Globes, Maps, and Skyways. By Hubert A. Bauer. Cloth, 75 pages, 5¾ by 8⅝ in., illustrated. Price, 40 cents.

In this volume are discussed the use of globes and maps for terrestrial and astronomical study.

Flying High. By Rose N. Cohen. Cloth, 320 pages, 5¾ by 8⅝ in., illustrated. Price, 76 cents.

A collection of aviation literature both interesting and inspiring.

Wings for You. By E. A. Cross. Cloth, 355 pages, 5¾ by 8⅝ in., illustrated. Price, 76 cents.

Another collection of interesting aviation stories.

The Air We Live In. By George T. Renner and Hubert A. Bauer. Cloth, 47 pages, 5¾ by 8⅝ in., illustrated. Price, 36 cents.

A study of meteorology, nature, and topography of the atmosphere, and of making weather maps.

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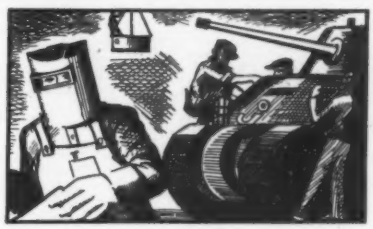

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A study of the effects of altitude, temperature, and acceleration on the nervous system, sense organs, circulation, and general health of those who fly.

Mathematics in Aviation. By George Osteyee. Cloth, 186 pages, 5¾ by 8⅝ in., illustrated. Price, 64 cents.

A review of the fundamentals of arithmetic and the calculation of areas and volumes, air travel, graphs, averages, metric systems, ratio, percentage, equations, and formulas, all applied to the aviation industry. There are also simple trigonometric and navigation problems.

Elementary School Science for the Air Age. By Charles K. Arey. Cloth, 145 pages, 5¾ by 8⅝ in., illustrated. Price, 72 cents.

A teacher's guide to a study of science as it is applied to aeronautics. It embraces a study of the atmosphere; natural flight; kites; balloons, and airplanes; weather; and the air age.

Education for the Air Age. By N. L. Engelhardt, Jr. Paper, 55 pages, 5¾ by 8⅝ in., illustrated. Price, 24 cents.

A teacher's guide in which are discussed the challenge of the air age, man's ability to fly, the world in which we live, and the planning and educational needs for victory and the air age.

Geographic Education for the Air Age. By George T. Renner. Paper, 17 pages, 5¾ by 8⅝ in. Price, 20 cents.

A guide for teachers and administrators covering a proposed program of geography for the elementary, junior high, secondary schools, and for higher education.

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(Continued on page 39A)

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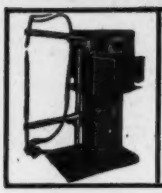

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(Continued from page 37A)

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Aircraft Welding

By L. S. Elzea. Cloth, 121 pages, 8½ by 11 in., illustrated. Price, $2. Published by The McGraw-Hill Book Co., New York City.

A book on gas welding devised for those who want to learn welding and its application to the work found in aircraft plants.

Sheet-Metal Pattern Drafting

By Frank J. O'Rourke and James A. Moyer. Cloth, 189 pages, 6⅛ by 9⅛ in., illustrated. Price, $2. Published by The McGraw-Hill Book Co., New York City.

An exposition of the various methods of making sheet-metal developments, such as parallel line, radial line, triangulation method, etc.

The Steel Square

By Noel D. Green. Cloth, 88 pages, 5¾ by 8⅝ in., illustrated. Price, $2.50. Published by the Chemical Publishing Co., Brooklyn, N. Y.

An explanation of how the carpenter's steel square is used for lumber calculations, or braced timber frames, for setting out angles and polygons, roof members, and in the laying out of staircase work.

The Superhet Manual

Edited by F. J. Camm. Cloth, 135 pages, 5¾ by 5⅝ in., illustrated. Price, $2.50. Published by the Chemical Publishing Co., Brooklyn, N. Y.

This is a handbook for the radio man. It contains an explanation of the fundamental radio principles, problems of selectivity, the principles of the superhet, general and aerial design, selectivity and noise suppression, and tone control.

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How to Prepare a Foreman's Policy Manual

By R. C. Oberdahn. Cloth, 7 by 9¾ in. Price, $6.50. Published by National Foremen's Institute, Deep River, Conn.

This manual shows how to prepare a foreman's policy manual. It contains exact replicas of the pages of a foreman's policy manual comprising various company policies, rules, practices, procedures, and regulations.

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Aircraft Inspection

By Ernest E. Wissman. Cloth, 268 pages, 6¼ by 9¼ in., illustrated. Price, $2.50. Published by McGraw-Hill Book Co., New York City.

Written by a man who himself has had much experience in inspecting aircraft both during and after production. This book presents the principles of inspection methods for the thousands who must prepare themselves for this type of work because of the present emergency.

Machine Shop Practice

By Sherman B. Hagberg in collaboration with Murlan S. Corrington and Raymond M. Biehler. Cloth, 311 pages, 8½ by 11 in., illustrated. Price, $2.50. Published by Harper and Brothers, New York, N. Y.

A book containing much explanatory material, concise directions for performing given operations, and a number of illustrative problems that may be used as presented, or in modified form, as projects in the machine shop.

The material is divided into eight units covering measuring instruments, drill-press operations, lathes, milling machine, shaper, benchwork, tools, and punches and dies.

The book contains numerous working drawings, and some very useful tables.

Air Pilot Training

By Bert A. Shields. Cloth, 602 pages, 6⅜ by 9⅛ in., illustrated. Price, $2.75. Published by McGraw-Hill Book Co., New York City.

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(Continued on page 41A)

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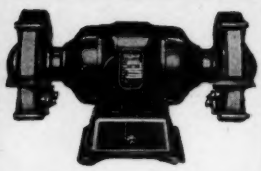

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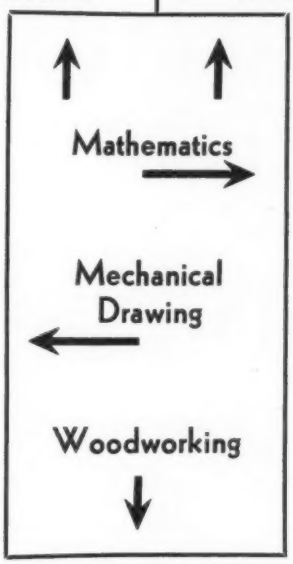

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